PROJECT MANUAL

WESTERN STATE HOSPITAL
NEW KITCHEN COMMISSARY PHARMACY
DSHS Project No. 2016-410G (2-1)
Building 22, Patient Support Center

Volume 2
Divisions 20-33

DEPARTMENT OF SOCIAL AND HEALTH SERVICES
Lakewood, Washington

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NAC
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Operation and Maintenance Manual.

1.3 SUBMITTALS

A. General: Comply with Section 200500 and Division 01.

B. Preliminary O&M: Submit preliminary review O&M manual for review.

C. Final O&M: Submit Final O&M manuals per Division 01.

PART 2 - PRODUCTS

2.1 GENERAL

A. General Contents: A maintenance manual shall be compiled containing maintenance and operating information and maintenance schedules for all project mechanical systems. See Division 01 for quantities, organization, format, and other requirements; meet additional requirements as specified herein.

2.2 SUBMITTAL DATA AND TECHNICAL O&M DATA

A. Submittal Data: Provide manufacturer’s technical product data, with manufacturer's model number, description of the equipment, equipment capacities, equipment options, electrical power voltage/phase, special features, and accessories. Label equipment and fixtures data with same designation as used on contract documents. This information may consist of the same information as the submittal data (clearly identified and marked to suit each item). This information shall be provided for all items requiring maintenance and for items that may require replacement over a 30 year period or be revised due to an Owner building improvement (includes plumbing fixtures, valves, plumbing specialties, equipment, dampers, etc.).

B. Technical O&M Data: Provide for each equipment or item requiring maintenance. Label O&M data to clearly indicate which equipment on the project it applies to (use same designation as used in the Contract Documents). Data to include:

1. Manufacturer’s operating and maintenance manuals and instructions.
2. Itemized list of maintenance activities and their scheduled frequency.
3. Maintenance instructions for each maintenance activity.
4. Manufacturer’s parts list.

5. Manufacturer's recommended lubricants.
6. Size, quantity and type of filters required (as applicable).
7. Size, quantity and type each belts unit requires (as applicable).
8. Size, quantity and type of fuses (as applicable).
9. Control devices calibration information.
10. System wiring diagrams and schematics.
11. Control sequence descriptions with setpoints and range of adjustments.

C. Sources: Provide names, addresses, and phone numbers for local manufacturer's representative, service companies, and parts sources for mechanical system components. List shall include all mech including: system riser components, valves, plumbing fixtures, and equipment HVAC system filters, belts, actuators, dampers controllers, relays, and sensors.

D. Start-Up Reports: Include copies of all equipment and system start-up reports.

E. Balancing Report: Include a full copy of the balancing report under a dividing tab for the specification section (or building system) where this work is specified. Where balancing is provided by others, obtain from the balancer a copy of the report to insert in the O&M's.

2.3 SYSTEM DESCRIPTIONS

A. General: Provide brief description of the project's mechanical systems to give an overview to Owner's maintenance and facilities staff.

B. Fire Suppression: Include type of fire suppression systems, system major characteristics, areas served, how system is sub-divided into zones, location of valves, how system is intended to operate, and significant safety or operational aspects.

C. Plumbing: Description shall include, but not be limited to, the following:

1. Plumbing Drainage Systems: Describe materials used, where main waste lines leave building, type of drainage systems, and any special systems (i.e. grease interceptor, acid waste piping) etc.
2. Domestic Hot and Cold Water Systems: Describe materials used, water main locations, pressure reducing valves, back-flow preventers types and locations, how system is sub-divided, water heater type, and locations, etc.
3. Special Piping Systems: Describe special piping systems, materials used, characteristics or each system, and locations (RO/DI water, steam, compressed air, etc.).

D. HVAC Systems: Description shall include, but not be limited to, the following:

1. Heating/Cooling System: Describe HVAC system type, general arrangements, zoning, how system is intended to operate, system setpoints, etc.
2. Equipment: Describe equipment types, locations, areas served, and any unique characteristics.
3. Special Exhaust Systems: Describe kitchen hood system, pharmacy exhaust, and other special exhaust systems.

E. Controls Systems: Include control system type, communication protocol, system major characteristics, system features/capabilities, normal system setpoints, and any significant safety or operational aspects.

2.4 MAINTENANCE SCHEDULES

A. General: Provide Maintenance schedules with an itemized list of maintenance activities and their scheduled frequency (i.e., weekly, monthly, semi-annually, etc.) for item requiring maintenance. This is to be a Contractor prepared listing derived from the manufacturer's operation and maintenance data and practical considerations.

B. Special Maintenance: List any critical maintenance items or areas requiring special attention.

C. Start-Up/Shut-Down: Provide normal start-up, operating, and shut-down procedures; emergency shut-down procedures; and (where applicable) seasonal shut-down procedures.

2.5 REDUCED RECORD DRAWINGS

A. Reduced As-Built Drawings: Provide reduced as-built construction drawings for plumbing, HVAC, and Controls. Drawings' size shall be 11" x 17", except where such size precludes the reading of portions of the drawing, a larger size may be used.

2.6 PHOTOGRAPHS

A. Photographs: Provide project photographs, as required by Section 200500.

B. Photographs Index: Provide index listing all photographs included. Organize index by building area or systems (i.e. underground photographs, building wings or areas, HVAC system, etc.).

PART 3 - EXECUTION

NOT USED

END OF SECTION 200200

SECTION 200500 - COMMON WORK RESULTS FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Division 22 - Plumbing Systems.

C. Division 23 - Heating, Ventilation, and Air Conditioning (HVAC) Systems.

D. Division 25 - Integrated Automation.

1.2 WORK INCLUDED

A. General Mechanical System Requirements.

B. Mechanical System Motors.

C. Identification and Labeling.

1.3 DEFINITIONS

A. Abbreviations and Terms: Where not defined elsewhere in the Contract Documents, shall be as defined in RS Means Illustrated Construction Dictionary, Fourth Addition and in the ASHRAE Handbook of Fundamentals, latest edition.

B. "As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all codes."

C. "Concealed" means "hidden from view" as determined when areas are in their final finished condition, from the point of view of a person located in the finished area. Items located in areas above suspended ceilings, in plumbing chases, and in similar areas are considered "concealed." Items located in cabinet spaces (e.g. below sinks) are not considered concealed.

D. "Coordinate" means "to accomplish the work with all others that are involved in the work by: directly discussing the work with them, arranging and participating in special meetings with them to discuss and plan the work being done by each, obtaining and completing any necessary forms and documentation required for the work to proceed, reaching agreement on how parts of the work performed by each trade will be installed relative to each other both in physical location and in time sequence, exchanging all necessary information so as to allow the work to be accomplished with a united effort in accordance with the project requirements".

E. "Finished Areas" means "areas receiving a finish coat of paint on one or more wall surface."

F. "Mechanical", where applied to the scope of work, includes all project plumbing systems, HVAC systems, and controls for these systems and all work covered by specification Divisions 20, 22, 23, and 25. Such work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

G. The term "related documents" (as used at the beginning of each specification section), and the Specification Divisions and Sections listed with it, is only an indication of some of the specification sections which the work of that section may be strongly related to. Since all items of work relate to one another and require full coordination, all specification sections, as listed in the Table of Contents, shall be considered as being "related documents", and shall be considered (by this reference) in the same manner as if they had all been listed under the term "related documents" in each specification section.

H. "Work included" (as used at the beginning of each specification section), and the items listed with it, is only an indication of some of the items specified in that Section and is in no way limiting the work of that Section. See complete drawings and specifications for all required work.

I. "Verify" means "Contractor shall obtain, by methods independent of the project Architect/Engineer and Owner, the information noted and the information needed to properly perform the work".

J. "Substitution": As applied to equipment means "equipment that is different than the 'Basis of Design' equipment scheduled on the drawings (or otherwise indicated in the contract documents)". Where no manufacturer is specifically indicated, any of the Acceptable Manufacturers specified may be equally considered the "Basis of Design". As applied to products other than equipment it means "products that are different than the basis of design product, or by a manufacturer not listed as one of the Acceptable Manufacturers".

1.4 GENERAL REQUIREMENTS

A. Scope: Furnish all labor, materials, tools, equipment, and services for all mechanical work. This section applies to all Division 20, 22, 23, 25 specifications and to all project mechanical work. All mechanical equipment and devices furnished or installed under other Divisions of this specification (or by the Owner) which require connection to any mechanical system shall be connected under this division of the Specifications.

B. General: All work shall comply with Division 00, General Conditions, Supplementary Conditions, Division 01, and all other provisions of the Contract Documents.

C. Code:

1. Compliance: All work shall be done in accordance with all applicable codes and ordinances. Throughout the Project Documents, items are shown or specified in excess of code requirements; in all such cases, the work shall be done so that code requirements are exceeded as indicated.
2. Documentation: Maintain documentation of all permits and code inspections for the mechanical work; submit documentation showing systems have satisfactorily passed all AHJ inspections and requirements.

3. Code Knowledge: Contractor and workers assigned to this project shall be familiar and knowledgeable of all applicable codes and ordinances. Code requirements are typically not repeated in the Contract Documents. By submitting a bid, the Contractor is acknowledging that the Contractor and workers to be utilized on this project have such knowledge.
4. Proof of Code Compliance: Prior to final completion, satisfactory evidence shall be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed. Satisfactory evidence includes signed inspections by the local code authority, test lab results, qualified and witnessed field tests, and related acceptance certificates by local code authorities, and field notes by the Contractor as to when all inspections and tests occurred.

D. Complete Systems: Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all mechanical systems. Not all accessories or devices are shown or specified that are necessary to form complete and functional systems.

E. Review and Coordination: To eliminate all possible errors and interferences, thoroughly examine all the Drawings and Specifications before work is started, and consult and coordinate with each of the various trades regarding the work. Such coordination shall begin prior to any work starting, and continue throughout the project.

F. Conflicts and Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts before proceeding with any work or the purchasing of any materials for the area(s) of conflict until requesting and obtaining written instructions from the Architect/Engineer on how to proceed. Where conflicts occur, the most expensive and stringent requirement (as judged by the Architect/Engineer) shall prevail. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed shall be done at the Contractor's expense.

G. Drawings and Specifications: Drawings and specifications are complementary and what is called for in either is binding as if called for in both. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not show all offsets, fittings and accessories which are required to form a complete and operating installation. Mechanical work is shown on multiple drawings and is not limited to a particular set of sheets, or sheets prefaced with a particular letter.

H. Offsets/Fittings:

1. Piping Systems: Include in bid all necessary fittings and offset to completely connect up all systems, maintain clear access paths to equipment, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payment or “extras” will be granted for the Contractor’s failure to correctly estimate the number of offsets and fittings and labor required. Contractor is advised that

equipment and fixture connections may require more than 20 elbows per plumbing fixture and coil per pipe line.

2. Duct Systems: Include in bid all necessary fittings, offsets, and transitions to completely connect all systems, maintain clear access paths, and comply with all project requirements. Offsets are required to route piping around building structural elements, roof slopes, mechanical systems, electrical systems, and numerous other items. Due to the schematic nature of the plans such offsets are typically not shown. Contractor is responsible to determine the quantity of offsets and fittings required, and the labor involved. No added payments or "extras" will be granted for the Contractor's failure to correctly estimate number of offsets, fittings, transitions and labor required. Contractor is advised that transitions are required at connections to all equipment, to all air inlets/outlets, crossing of beam lines, at crossing with piping, and similar locations.
3. Added Offsets: In addition to offsets and fittings required per the above paragraphs, include in bid costs 2 added elbows for each 30 feet of pipe and duct run. Such offsets shall be of same size and material of connecting runs. Offsets shall be bid as 90-degree elbows. The Owner reserves the right to obtain credit for any elbows required by this paragraph but not actually used. Added offsets shall be calculated based on project total accumulated duct (or pipe) lengths, with lengths rounded up to the nearest 30' in order to calculate offsets. (For example, if project had 5 feet of 24 x 8 duct in one location, and 8 feet of 24 x 8 duct in another location, total accumulated length of 24 x 8 would be 13 feet, round up to 30 feet, with calculated offsets to be provided as 2).

I. Design: The level of design presented in the documents represents the extent of the design being furnished to the Contractor; any additional design needed shall be provided by the Contractor. All design by the Contractor shall be performed by individuals skilled and experienced in such work, and where required by local code (or elsewhere in the documents) shall be performed by engineers licensed in the State where the project is located. Include in bid the costs of all such project design; including engineering, drafting, coordination, and all related activities and work. Such designs services are required for many building systems; including but not limited to ductwork at equipment, piping at fixtures and equipment, hanger/support systems, temporary duct/piping systems, mechanical offsets/adjustments to suit other system, and for methods/means of accomplishing the work.

J. Special Tools: Furnish to the Owner one complete set of any and all special tools such as odd size wrenches, keys, etc. (allen wrenches are considered odd), which are necessary to gain access to, service, or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use. Submit a written record listing the special tools provided, date, and signed by the Owner's representative receiving the tools.

K. Standards and References: Shall be latest edition unless a specific edition, year, or version is cited, or is enforced by the AHJ.

L. Warranties:

1. General: Products and workmanship shall be warranted to be free from all defects, capable of providing satisfactory system operation, and conforming to the requirements of the Contract Documents. Include in the project bid all costs associated with project warranties to ensure that the warranty extends for the

required period; possible project delays and failure by others to complete their work may cause the start of the warranty period to be delayed. The Contractor shall be responsible for increasing the warranty dates by corresponding amounts to provide the required warranty periods.

2. Basic Project Warranty: As described in Division 00 and 01. See individual specification sections for specific warranty requirements. Start date and duration are as indicated in Division 00 and 01. Where not indicated otherwise in Division 00 or 01, the basic project warranty shall start at project substantial completion and be for one year.
3. Special Warranties: See individual specification sections for special warranty requirements and extended warranty periods beyond the basic project warranty.

M. Special Work Requirements: See Contract Documents regarding building occupancy type, type of construction, special work areas, or other requirements where special products, special installation methods, or special phasing may be required. Code requirements are typically not repeated in the Contract Documents and certain building types or classifications may involve special requirements; Contractor is responsible to carefully review the Contract Documents and code to identify such work.

N. Permits and Fees:

1. Obtain and pay for all permits, licenses, fees and inspections as required by the Code and as specified herein (unless noted otherwise).
2. Pay all charges made by any utility company or municipality for material, labor or services incident to the connection of service (unless noted otherwise).

O. Commissioning: All mechanical systems are to be commissioned per Sections 019113, 200800, 220800, 230800 and 250800. The Contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing. Reference Division 01 and coordinate all commissioning activities with the Commissioning Authority.

P. LEED: This project is pursuing USGBC LEED certification. This certification process requires certain reports and documentation from the Contractor; and the use of specific energy efficient and environmentally friendly materials and systems. See USGBC, Division 01, and individual specification sections for specific requirements.

1.5 SUBSTITUTIONS

A. General: See Division 00 and 01 for information and requirements regarding substitutions. A substitution request form (see Division 01) is not required for manufacturers listed as “Acceptable Manufacturers”.

B. Redesign:

1. The Contract Documents show design configurations based on particular

manufacturers. Use of other manufacturers' equipment (i.e. substituted equipment) and products from what is shown (or specified) may require redesign of mechanical, plumbing, controls, fire protection, electrical, structural, and general building construction to accommodate the substitution.

2. Review requirements for substitutions and provide redesign of all affected construction. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns.
3. Redesign shall be done by the Contractor and shall meet the requirements and have the approval of the Architect/Engineer prior to beginning work.

C. Submittals: In addition to other required submittals, submit shop drawings showing the redesign for substituted equipment; submittal shall include installation plans and sections, connecting services (i.e. ducts, piping, electrical) locations and routing, required service clearances, and related installation details. Submit data required by other disciplines to allow review of the impact of the substitution (i.e. weights, electrical).

D. Costs: Cost of redesign and all additional costs incurred to accommodate substituted equipment shall be borne by the Contractor.

1.6 QUALITY ASSURANCE

A. Experience: All work shall be performed by individuals experienced and knowledgeable in the work they are performing, and experienced with the same type of systems and building type as this project. By virtue of submitting a bid, the Contractor is acknowledging that workers to be utilized on this project have such experience and knowledge. Upon request of the Engineer, submit resumes showing the work history, training, and types of projects worked on, for individuals assigned to this project.

B. Code: Utilize workers experienced and knowledgeable with codes pertaining to their work; verify code compliance through-out the project.

C. ASME: All pressure vessels, pressure vessel safety devices, and pressure vessel appurtenances shall comply with the standards of, and bear the stamp of ASME.

D. Quality Assurance Checks: Prior to ordering products and making submittals, confirm the following for each:

1. General: Product is suitable for the intended purpose and complies with the Contract Documents.
2. Manufacturer: Product's manufacturer is listed as an acceptable manufacturer in the Contract Document’s or a substitution request (where allowed) has been submitted and the manufacturer has been listed as acceptable.
3. Electrical (for products requiring electrical power):

    a. Product is for use with the voltage/phase as indicated on the electrical plans (or for the electrical circuit the item will be connected to).

b. Product's ampacity requirements (MCA) do not exceed that indicated on the electrical plans (or for the electrical circuit the item will be connected to).

4. Weight: Product's weight is no greater than that indicated.
5. Space Verification: Product will fit in the space available, and along the path available to install the item, will have adequate service clearances, and will not impede on any clearances required for other items in the space the item will be located.
6. Installation: A suitable method for installing the product has been selected which meets the project schedule and other requirements.
7. Lead Time: The product's fabrication, shipping, and delivery period meets the project schedule requirements.
8. Substituted Equipment: Where equipment is not the basis of design confirm all requirements for substituted equipment have been met and shop drawings of construction revisions have been (or are being) prepared.
9. Controls: Item is compatible with the controls it will be connected to and has been coordinated with the firm providing the project control work.
10. Listing: Item is Listed when required to be as such. And if the item is to be installed as part of a Listed system or assembly, it is compliant with the Listing of the overall system or assembly.

E. Check-Out: The Contractor shall be responsible to verify that proper installation and proper connections have been provided for all mechanical work. Contractor shall provide installation checkout, start-up services, and perform a thorough check of all mechanical systems to verify proper installation and operation. Contractor shall operate all items multiple times under varying conditions to confirm proper operation. Contractor shall submit a checklist listing all equipment, fixtures, and similar items furnished on this project, with a date and initials indicating when the item was checked, a list of what was checked, and by whom. Such check shall, as a minimum utilize documents provided by the equipment manufacturer. Such a check-out is in addition to any commissioning activities specified (unless noted otherwise).

1.7 SUBMITTALS - GENERAL

A. Variations: Only variations that are specifically identified as described herein will be considered. Provide with the submittal (in addition to other information required): description of the proposed variation, entity who is proposing the variation, why the variation is being proposed, any cost changes associated with the variation, and any other pertinent data to allow for review. Failure to submit information on the variation as described will result in the submittal review being conducted without considering the variation.

B. Quality Assurance: By submitting an item for review, the Contractor is claiming that all “Quality Assurance Checks” (see paragraph 1.6 this specification Section) have been performed and satisfactorily passed and no further comment from the submittal reviewer is required for the “Quality Assurance Checks”.

C. Product Submittals - Information Required:

1. Manufacturer's catalog information, containing product description, model number, and illustrations. Mark clearly to identify pertinent information and exact model and configuration being submitted.
2. List of accessories and options provided with product.
3. Product dimensions and clearances required.
4. Product weight.
5. Submittal identified with product name and symbol (as shown on the drawings or written in the specifications) and specification Section and paragraph reference.
6. Performance capacity and characteristics showing compliance with the Contract Documents.
7. Manufacturer's and local manufacturer's representative names, addresses, and phone numbers.
8. For equipment requiring piping or duct connections:

    a. Type of connections required.
    b. Size and locations of connections.

9. For electrically operated equipment:

    a. Number and locations of electrical service connections required.
    b. Voltage required.
    c. Fuse or circuit breaker protection requirements.
    d. Motor starter requirements; if motor starter is furnished with the equipment, submit product information on motor starter.

10. For equipment requiring control connections:

    a. Type of control signals required.
    b. Control communication protocol.
    c. Information on control devices furnished with equipment.
    d. Location of control connections.

11. Manufacturer's installation instructions.
12. See each specification Section for additional submittal requirements.

D. Shop Drawing Submittals: Provide for the following systems:

1. HVAC control systems.
2. For any parts of any system which are to be installed differently than as shown on the drawings.
3. Construction revisions to accommodate Substituted Equipment.
4. Other areas/work as noted in the Contract Documents.
5. For those systems requiring shop drawings, reference system's specification Section for additional requirements.

1.8 SCHEDULE OF VALUES

A. Breakdown: Provide schedule of values for the following categories (as a minimum); provide a materials and labor breakdown for each category:

1. Mobilization.
2. General Project Management, General Design, General Coordination, Submittals.

3. Insulation.
4. Plumbing:

    a. Underground.
    b. Aboveground.
    c. Fixtures and Trim.
    d. Roof Drainage.

5. HVAC System:

    a. Air Handling Units.
    b. VRF Equipment.
    c. Refrigeration Piping.
    d. HVAC Ductwork and Accessories.

6. Controls:

    a. Engineering and shop drawings.
    b. Rough-in.
    c. Trim.
    d. Programming.

7. Balancing.
8. Commissioning.
9. O&M Manual, Record Data.
10. Punchlist, Closeout, Owner Training.

B. Closeout: The dollar value for "Punchlist, Closeout, and Owner Training" shall in no case be less than 3% of the total dollar value of the mechanical work.

C. Proof of Operation: In addition to payments held out for retainage and project final completion as specified above and in Division 01, the Owner reserves the right to withhold a percentage of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested, adjusted, commissioned, and balanced.

1.9 RECORD DOCUMENTS

A. Field Record Drawings: Maintain a set of full size contract plans at the project site upon which all changes from the as-bid plans are noted. Plans shall be maintained clean, dry and legible; with information recorded concurrent with construction progress. These plans shall also include actual locations (with dimensions) of all underground and concealed mechanical systems. Connection points to outside utilities shall be located by field measurements and so noted on these record drawings. All addenda, change order, field orders, design clarifications, request for information, and all other clarifications and revisions to the plans shall also be made a part of these record drawings. Plans shall be available for weekly review by the Architect/Engineer. Label drawing “As-Builts” with date, name of Contractor, and name of individual overseeing the work.

B. Final Field Record Drawings Submittal: Deliver to the Architect/Engineer the original Field Record drawings and one full size copy.

C. Photographs: Photograph with minimum 10 megapixel digital camera (or better) all concealed utilities located below ground, under floors, and in building. Photographs shall be taken prior to any insulation being installed, and with multiple views so as to allow clear understanding and locations of the systems from the photographs. Furnish prints on 8-1/2 x 11 paper, with two 5 x 7 photographs per page. Label each photograph, as to location photographs are taken and system(s) indicated, and provide two sets of 3-ring notebooks with photographs. Provide divider tabs in notebook, and organize photographs in logical groupings; provide table of contents listing all photographs. Provide a labeled CD's containing all photographs, one with each notebook.

1.10 PRODUCT HANDLING, PROTECTION AND MAINTENANCE

A. Protection:

1. Protect all products from contamination, becoming unclean, and from damage of any kind and whatever cause; when being handled, in storage, and while installed, until final project acceptance.
2. Completely cover fixtures, motors, control panels, equipment, and similar items to protect from becoming unclean and damage of any kind.
3. Protect premises and work of other trades from damage due to Mechanical work.

B. Openings: Cap all openings in pipe, ductwork and equipment to protect against entry of foreign matter until all work that could cause unclean conditions or damage is complete (including work that has dust or fumes associated with it). Caps shall be of sufficient strength and seal integrity to prevent entry of water or fumes for the most extreme conditions they may be exposed to (i.e. high velocity water spray, high winds, concrete splash, etc.)

C. Storage: Provide properly conditioned and sheltered storage facilities for products to prevent damage of any kind and to maintain new condition. Provide adequate venting arrangements to avoid condensation damage.

D. Operation and Maintenance:

1. General: Inspect products periodically to confirm conditions and maintenance needs. Keep records of inspections and (upon request) forward to the Architect/Engineer prior to project final acceptance. Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.
2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, flush, cleaning, etc.) and inspection on products while stored to maintain new condition.
3. Installed Products: Provide maintenance and inspection of products and operate mechanical systems until project final acceptance or specified Owner Instruction has been provided (whichever is later). Maintenance shall include all labor and materials and all manufacturers' recommended maintenance (i.e. strainer cleaning, filter changes, bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent

with best practices for the product but in no case less than a site visit every two weeks. Document all maintenance activities.

E. Damaged Products: Damaged products shall be replaced with new. Where damage is limited to paint (or similar finish), the product may remain if the finish is restored to a new condition (as judged by the Architect/Engineer).

1.11 JOB CONDITIONS

A. Special Requirements:

1. Maintain emergency and service entrance usable to pedestrian and vehicle traffic at all times. Where trenches are cut, provide adequate bridging for traffic.
2. Coordinate startup and shutdown of all mechanical systems and utilities with related trades and the Owner's representative.
3. Coordinate all construction activities with the Owner's Representative and cooperate fully so as to minimize conflicts and to facilitate Owner usage of the premises during construction.
4. Provide temporary services to occupied areas to accommodate Owner's use during construction. All temporary work shall comply with same specifications as for new work and be of same quality.

B. Downtime Restrictions:

1. Contractor shall notify the Owner at least 72 hours in advance of any intended shut-down of any building services or systems and obtain Owner approval prior to proceeding.
2. Electrical power to the building shall not be interrupted at any one time for more than 15 minutes.

C. Schedule of Work: Arrange work to comply with schedule of construction, and so as not to violate any downtime restrictions, and to accommodate the Owner's scheduled use of the premises during construction.

1.12 ENGINEER REVIEWS AND WITNESSING

A. General: Arrange construction schedule and notifications to the Engineer to accommodate Engineer’s schedule and the possibility of review times occurring up to 14 days after notification, and for the possible failure to satisfactorily pass Engineer’s reviews requiring revisions and re-reviews.

B. Notification: Notify Engineer at least 7 days in advance of readiness for reviews; arrange mutually agreed upon times for the reviews to occur.

C. Access: Provide ladders, any special tools and safety equipment to allow Engineer's access to areas and equipment. Remove and reinstall ceiling tiles, access panels, and similar items where requested to allow for reviews.

D. Review of Systems with Equipment:

1. Prior to Engineer's review, system's equipment shall have received specified start-up and be substantiated by a written report.
2. Prior to Engineer's review, systems shall have been operating properly for at least five consecutive days prior to the scheduled review date.
3. Personnel shall be present to operate the system's equipment and controls, and to vary system settings as directed by the Engineer to allow for a review of operation over a range of settings.

E. Re-Review Fees: The project budget allows for one review by the Engineer for specified reviews and witnessing. See Division 00 and 01 for compensation to the Engineer for required re-reviews.

1.13 REFERENCES

A. ASME A13.1: Scheme for the Identification of Piping Systems.

B. NFPA 791: Unlabeled Electrical Equipment Evaluation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Any reference in the Specifications or on the Drawings to any article, device, product, material, fixture, form or type of construction by manufacturer, name, make, model number, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The manufacturers listed as Acceptable Manufacturers may bid the project for the items indicated without submitting a substitution request.

B. Substitutions: Other manufacturers desiring to bid the project require prior approval. See Division 01 for substitution requirements. In reviewing a manufacturer for acceptance, factors considered include: engineering data showing item's performance, proper local representation of manufacturer, likelihood of manufacturer's future local support of product, service availability, previous installations, previous use by Owner/Engineer/Architect, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items geometry and access, utility needs, and similar concerns.

C. Limitations: The listing of a manufacturer as an Acceptable Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which have represented themselves as being capable of manufacturing, or have in the past manufactured, items equal to those specified. The Architect/Engineer shall be the final judge as to whether an item is equal to that specified.

D. Quality: Products provided by Acceptable Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the Contract Documents. The Architect/Engineer shall be the judge as to whether an item meets these requirements or not.

E. Manufacturer: To be considered as being made by a particular manufacturer, the product must be made directly by the manufacturer and have the manufacturer's name (or nameplate with name) affixed to the product (or on the product container where direct labeling is not possible). Example: manufacture "A" is listed as an acceptable manufacture; manufacturer "B" is not listed as an acceptable manufacturer; manufacturer "A" owns "B"; products from "B" do not qualify as being made by an acceptable manufacturer by virtue of ownership.

2.2 PRODUCTS - GENERAL

A. Standard Products: Products shall be standard products of a manufacturer regularly engaged in the manufacture of such products. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The two year's experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Except that equipment changes made solely to satisfy code requirements, to improve unit efficiency, or to comply with unique project requirements are not required to have two year prior operation.

B. Latest Design: Products shall be the latest design and version available from the manufacturer, including software. Discontinued products shall not be used.

C. Service Support: Qualified permanent service organizations for support of the equipment shall be located reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

D. Manufacturer's Nameplate: Equipment shall have a manufacturer's nameplate bearing the manufacturer's name, address, model number, serial number, and additional information as required by code. Nameplate shall be securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable. Nameplate shall be of durable construction, easily read, with lettering minimum size 12 font.

E. Compatibility: All components and materials used shall be compatible to the conditions and materials the items will be exposed to. All items exposed to the weather shall be galvanized, or be of stainless steel or similar corrosion resistant material.

F. Sizes: Sizes indicated for products manufactured to standardized sizes (e.g. pipe, pipe fittings, valves, material gauges, etc.) are minimums. During bidding confirm that the sizes are available and meet project requirements. Where indicated sizes are not available provide the next larger available size; confirm this larger size will suit the construction and meet Contract Document requirements prior to ordering. Such size revisions are subject to Engineer's review; indicate size revisions on the product submittal and why the size is being revised.

G. Non-Specified Items: Materials shown on the drawings but not specified shall be provided as shown and as required to suit the application illustrated and intended and shall be of commercial quality, consistent with the quality of similar type items provided on the project. Not all items shown on the drawings necessarily have a corresponding

specification; such items shall be provided per this paragraph and so as to provide complete, finished, fully functioning mechanical systems.

H. Weights: Do not exceed the weights shown unless added structural supports are provided. Such supports shall meet the requirements of the project Structural Engineer. The Contractor shall bear all costs for all redesign and added supports to accommodate heavier equipment. The Contractor shall reimburse the Engineer for all time associated with all review and analyses regarding the use of equipment heavier than that indicated.

I. Temperature/Pressure Rating: All materials and components furnished shall be suitable for the temperature and pressures they will be exposed to. Contractor shall consider possible operating modes to ensure proper material ratings. Consideration shall include such factors as high temperatures caused by heat transfer from piping, coils, etc. when fans are shut down (e.g., motors, control devices, etc. installed within air handling units or mechanical rooms shall be rated for high temperatures due to such heat gain).

J. Standardization: All products of the same type shall be by the same manufacturer and have the same characteristics and features to allow for Owner's standardization.

K. Model Numbers: Any reference to a manufacturer's "model number" is a reference to a manufacturer's series number or type of product, and is not a complete "model number" in having all the necessary numbers/letters to convey all of the features, accessories, and options that are required. These series numbers are only meant to convey a type of product that may meet the project requirements. Where conflicts or discrepancies occur regarding a listed manufacturer's series or "model" number and specified capacities or features, the more stringent and expensive shall prevail.

L. Special Products: Numerous products specified for this project are custom products, and require special and unique construction and features. Such special items may include: finishes, controls, field NRTL (Nationally Recognized Testing Laboratory) re-certification, field evaluations by accredited product testing laboratories for certification for the application, construction, configuration, capacities, accessories, spare parts, warranty, testing, flow rates, application, installation, delivery date, cleaning, etc. Include in bid all costs to provide items meeting all project requirements. Products may reference a manufacturer's series number, but are still special and custom, with the series number identifying only a reference point for the unit manufacturer. The series number is not to be construed as limiting the features or capabilities of the item. Contractor shall review all requirements and all vender quotes to ensure all requirements are being met and to include all costs in bid. No added cost will be paid for failure to include in bid all costs necessary to provide the special, unique, and custom items required.

M. Lead Free: All solder, valve components, drinking fountain components, and other items in contact with potable water shall be lead free.

2.3 ELECTRICAL

A. General: All electrical devices, wiring, products, and work shall comply with the Division 26 specifications and code. See drawings for building occupancy type, types of construction, and areas which may require special wiring methods or other electrical work.

B. Equipment: All equipment requiring power shall be factory wired to an equipment mounted junction box (or an accessible compartment with power terminals or electrical device) arranged to allow for connection of electrical power.

C. Overcurrent protection: Circuit breakers, circuit breaker disconnects, fuses, and other current limiting devices indicated to be provided, shall be rated to suit the maximum overcurrent rating of the item served, and have other ratings, as required by code. Circuit breakers for HVAC and refrigeration unit equipment shall be UL listed by HACR type.

D. Fault Current AIC Rating: All equipment requiring the use of electrical power shall have a fault current rating complying with code. The minimum rating shall be 65,000 AIC; except where a lower fault current value is indicated on the drawings, or code allows uses of a lower number. Where the Contractor wishes to utilize equipment having fault current limitations lower than 65,000 AIC (or as shown on plans, whichever is less), the Contractor shall be responsible to provide suitable fusing, additional devices, and/or other changes to the building electrical system as necessary to accommodate the proposed equipment.

E. Short Circuit Current Rating (SCCR): All equipment (or components) requiring the use of electrical power shall have a SCCR value to comply with code. The minimum rating shall be 22,000 Amps RMS Symmetrical unless a lower value is indicated on the plans or allowed by code. Where the Contractor wishes to utilize equipment having a lower rating, the Contractor shall be responsible to provide calculations substantiating that a lower SCCR is acceptable (and complies with code), or make system revisions to accommodate the proposed component.

F. Product Certification (Listing): Products which require connection to electrical power shall be certified (i.e. listed) by a Nationally Recognized Testing Laboratory (NRTL) and be labeled (in a conspicuous place) with such certification (or certification mark). Certification shall comply with code, OSHA Standards, and Authority Having Jurisdiction (AHJ) requirements. NRTL's shall be recognized as such by OSHA and the AHJ. Certification shall be for the complete assembly (approval of individual components is not acceptable). Field evaluations to obtain certification shall be performed by accredited product testing laboratories acceptable to the AHJ and Engineer, be performed in accordance with code, NFPA 791, recognized practices, and be labeled to identify the certification. Certification is not required where the AHJ does not require it.

2.4 MOTORS

A. General: Where a piece of equipment specified includes an electric motor, the motor shall be factory installed and mounted. Motor starters and motor electrical disconnect switches shall be provided by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26 (or another Division). Wiring from the motor to motor starters and to electrical disconnects shall be by the Contractor doing the work of the Section where the item was specified, unless specifically shown to be provided by Division 26.

B. Acceptable Manufacturers: General Electric, TECO-Westinghouse, Reliance, Gould, Century, Baldor, U.S. Motors, Marathon, and acceptable manufacturers for the equipment (see individual specification sections).

C. Type: Motor type shall comply with code and applicable standard requirements and be configured to suit the application. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise. Motors used in fans serving dishwashing hoods and kitchen hoods shall be TEFC type.

D. Listing: All motors shall be UL listed.

E. Efficiency: Motor efficiencies shall comply with code. Fractional horsepower motors shall be the electronically commuted (EC) type with speed control where noted and where non-EC motors are not available which comply with code efficiency requirements. Motor power factor shall comply with code, local utility requirements, and as indicated. Provide added power factor correction devices as necessary to comply.

F. Sizing: Motors shall not be smaller than indicated and of adequate size to start and drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at the conditions indicated and for the expected operating conditions. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.

G. Service Factor: Minimum 1.15.

H. Variable Frequency Drive (VFD) Applications: Motors used with Variable Frequency Drives (VFD's) shall be rated for such use per IEEE standards and have shaft grounding protection.

I. EC Motors (ECM):

1. General: Electronically commutated type with integral inverter to convert AC power (of voltage/phase indicated) to DC power, and solid state circuitry to vary output power and speed of motor. Motor shall have permanently lubricated bearings with an L10 life of 100,000 hours at expected operating conditions. Motor shall have rotor position and rotation detection as required for operation.
2. Speed Range: Motor speed shall be controllable down to 25% of full speed.
3. Manual Speed Control: Provide with manual speed adjustment dial for motor speed control. Dial shall be motor mounted unless indicated otherwise, operable by a screwdriver or by hand. Motor mounted controls shall be factory wired. Remote mount dials shall be hand operable (i.e. no tools required), shall be for mounting on a standard 2 x 4 electrical junction box, and be able to be located up to 100 feet remote from the motor. Motor control wiring for remote mount dials shall be factory wired from the motor to an equipment mounted junction box (with field supplied wiring from this J-box to the remote dial).
4. EMCS Control: Motor speed shall be adjustable via a remote 0-10V input signal (unless noted otherwise) from the building EMCS. Control wiring shall be factory wired from the motor to an equipment mounted junction box. EMCS

control is not required where not indicated to be provided or where not utilized as part of the control sequence.

5. Control Power: Provide with integral transformer, factory wired, as needed to power motor controls. Locate transformer at motor or equipment.
6. Alarms: For EC motors 1 HP and larger provide with integral controls to detect the following failures and to automatically reset motor after failure remedy: phase failure, power failure, low voltage, locked rotor, motor high temperature. Provide with integral controls to detect the following failure with manual reset (by power disconnect): rotor position failure, electronics high temperature.

2.5 IDENTIFICATION AND LABELS

A. General: All piping, valves, and mechanical equipment shall be labeled. Labels in concealed accessible spaces shall be reviewed and verified by Architect/Engineer prior to being concealed.

B. Piping:

1. Type: Self-sticking colored identification markers, lettered to identify the pipe contents, and banded at each end with arrow tape indicating the direction of flow. Markers shall be similar and equal to Brady "System 1" and Seton "Opti-Code" markers. Spray painted stencil labeling is not acceptable. Some labels may be special order.
2. Identification Colors: Comply with ASME A13.1, and as follows:

Conveyed Material/System	Background	Letters
Steam	Yellow	Black
Potable Water	Green	White
Reverse Osmosis Water	Green	White
Compressed Air	Blue	White
Instrument Air	Red	White
Refrigeration	Black	White
Waste/Vent	Gray	White

3. Lettering: Lettering shall identify the material conveyed in each pipe and shall match the designation used on the plans, but without abbreviations. Systems which have supply and return piping shall have piping labeled as such (i.e. heating water return, heating water supply, etc.). Systems that have different pressures shall be labeled to indicate such (i.e. Steam-Low Pressure, Steam-Medium Pressure, Natural Gas-Low Pressure, Natural Gas-Medium Pressure, etc.).
4. Size: Size of letters and color field shall comply with ASME A13.1, repeated here for convenience:

Outside Diameter of Pipe or Covering	Length of Color Field	Size of Letters
3/4 to 1-1/4 Inches	8 Inches	1/2 Inches
1-1/2 to 2 Inches	8 Inches	3/4 Inches
2-1/2 to 6 Inches	12 Inches	1-1/4 Inches
8 to 10 Inches	24 Inches	2-1/2 Inches
Over 10 Inches	32 Inches	3-1/2 Inches

5. Applications: Install on all exposed piping adjacent to each shut-off valve, at branches to indicate changes of direction, where pipes pass through walls and floors, on 20 foot centers or at least one in each room on each pipe. Markers shall be installed on all concealed accessible piping (i.e., piping above suspended ceilings, behind access doors, in accessible chases, etc.) near the point of access. For piping above suspended ceilings, markers shall be installed the same as if the piping was exposed (i.e., same as if the suspended ceiling was not in place). Markers shall be installed so as to be easily read by a person standing on the floor. Provide additional flow arrows at each pipe connection at valves having more than 2 ports (i.e. 3-way control valves).
6. Other Requirements: See other specification Sections for additional requirements.

C. Valves:

1. Labels: Laminated plastic or phenolic material, at least 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer for letter engraving to expose sub-layer. Labels shall not be less than 3" x 1" in size. Label shall be pre-drilled at one end for attachment to valve. Attach to valve with No. 6 polished nickel-steel jack chain of sufficient length to allow label to hang free.
2. Lettering: Engrave label with valve size, name of system served (cold water, heating water supply, chilled water supply, etc.) and purpose of valve. Lettering size 3/16-inch, except where needed to be smaller to fit label size.
3. Application: Labels shall be installed on all valves except valves at hydronic system coils and equipment where the valve purpose is readily obvious.
4. Valve Charts: Valve charts shall be provided for each mechanical room providing valve data for emergency, main building, and main area shut-off valves. Valve charts shall be neatly typed on 8-1/2" x 11" paper and framed under plastic with an aluminum (or wood) frame and posted in the appropriate room at a visible location acceptable to the Architect/Engineer. Sample chart organization:

"PROJECT NAME"
MAIN VALVE CHART

Valve Size	Service	Location	Purpose
6 Inch	HWS Main	Mechanical Room 101 NW Corner	Main HWS Shut-off
3 Inch	HWS	Above Ceiling NE Corner, Room 151	North Wing HWS Shut-off

D. Equipment:

1. Labels: Laminated plastic (or phenolic) material, 1/16-inch thick, with black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Minimum 2-inch high (unless indicated otherwise or required due to equipment size) with length to contain required lettering. Label shall be pre-drilled and be mechanically fastened to the equipment. Prior to making labels, submit a list of all proposed labels.
2. Lettering: All caps, engraved on label, with equipment designation (same designation as used on Contract Drawings; e.g. HVAC-101, EF-22, CP-1A). Air

handling equipment (i.e. VAV terminal units, fans, etc.) labels shall include the room names and numbers or area of building served (use final installed room designations). Where systems serve portions of the building (i.e. wings or floors), include on label the area served. Lettering shall be in multiple rows, with equipment label on top row. Equipment lettering to be 5/8-inch high; area served lettering to be 3/8-inch high (except that smaller lettering may be used if necessary to fit label size).

3. Application: All scheduled mechanical equipment shall be labeled. The label shall be located on a side of the equipment so as to be easily read, with the marking visible to a person standing at the access level near the equipment (assuming any necessary access to a concealed unit has been made).

E. Electrical Devices:

1. Labels: Minimum 1/4-inch high (unless indicated otherwise) lettering, all caps, engraved on laminated plastic or phenolic material, at least 1/16-inch thick. Laminated plastic (or phenolic) shall have black surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the item; where mechanical fastening is not possible use 3M VHB double sided specialty tape No. 4945. Prior to making labels, submit a list of all proposed labels.
2. Lettering: Label shall identify the item served (using the same designation as indicated on the Contract Drawings), the source of power (by panel and circuit breaker), and comply with code.
3. Application: Variable frequency drives, motor starters, disconnects, contactors, relays and similar items which control power to equipment and system components shall be labeled. The label shall be located so as to be easily read. See Division 25 for labeling of low voltage control components.

F. Duct Access Doors:

1. Labels: Minimum 1-inch high (unless indicated otherwise) lettering, engraved on laminated plastic or phenolic material, at least 1/16th inch thick. Laminated plastic (or phenolic) shall have red surface layer and white (unless other color indicated) sub-layer, with engraving through to expose white sub-layer. Label shall be pre-drilled and be mechanically fastened to the duct access door.
2. Lettering: Label shall comply with code, and indicate the item being accessed (i.e. Fire/Smoke Damper, Fire Damper, CO2 Sensor, etc.).
3. Application: All duct access doors serving fire dampers, fire/smoke dampers, smoke dampers, control dampers, items required by code, and control devices shall be labeled where these items are provided under Division 26, they shall be labeled by Division 26. Access door label is not required where it is readily obvious as to what is being accessed (e.g. duct coil where coil is easily seen). The label shall be located so as to be easily read, with the marking visible to a person standing at the access level near the access door (assuming any necessary access to a concealed label has been made).

G. Concealed Items: Equipment, valves, dampers and similar items concealed above accessible ceilings shall have the ceiling marked below the item to identify the item and its location. The marking system shall consist of printed labels made by a professional labeling machine, black lettering on clear self sticking tape, with minimum 1/2-inch high

lettering using Arial font. Apply labels to ceiling grid below concealed item. Labels shall identify equipment using the same designation indicated on the plans; valves shall be identified by size and system (e.g. EF-1, VAV-101, VALVE 4" CW). Prior to making labels, submit a list of all proposed labels.

H. Plan Posting: Post reduced as-builts in mechanical. As-builts shall be 11" x 17" in size, and be laminated in clear plastic. Post complete HVAC and plumbing plans and system schematics in mechanical room.

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship: Furnish and install products to provide complete and functioning systems with a neat and finished appearance. If, in the judgment of the Architect/Engineer, any portion of the work has not been installed in accordance with the Contract Documents and in a neat workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall be required to revise the work so that it complies with the Contract Documents, at no increase in cost to the Owner.

B. Coordination: Coordinate the work with all trades that may be affected by the work to avoid conflicts and to allow for an organized and efficient installation of all systems.

C. Examination and Preparation: Examine installation conditions and verify they are proper and ready for the work to proceed. Verify compatibility of materials in contact with other materials, and suitability for conditions they will be exposed to. Do not proceed with the work until unsatisfactory conditions have been corrected. Prepare area to accept the work and prepare products for the installation.

D. Field Conditions: Check field conditions and verify all measurements and relationships indicated on the drawings before proceeding with any work. In verifying existing conditions, the Contractor shall verify by direct physical inspection, complete tracing out of systems, by applying test pressures, by excavation and inspection, use of pipeline cameras, and other suitable absolute certain methods to confirm the actual physical conditions that exist.

E. Openings and Cutting and Patching in New Construction:

1. Openings - General: The General Contractor shall provide all required spaces and provisions in structures of new construction for the installation of work of all other contractors or subcontractors.
2. Coordination: The Contractors doing work subject to Division 20 shall furnish to the General Contractor (in a timely manner) all needed dimensions and locations of openings to allow for these openings to be provided as the construction adjacent to the opening is being done.
3. Cutting and Patching: Cutting and patching of structures in place made necessary to admit work, repair defective work, or by neglect of contractors and subcontractors to properly anticipate their requirements, shall be done by the General Contractor at the expense of the contractors or subcontractors responsible. Work shall be done in a fashion to duplicate the results that would have been obtained had the work been properly sequenced.

4. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.

F. Cleaning: Clean all products (whether exposed to view or not) of all construction debris, and other materials; grease and oil spots shall be removed with appropriate cleaning agents and surfaces carefully wiped clean. Where cleaning cannot restore items to new conditions, the item shall be replaced with new.

3.2 INSTALLATION

A. General: Work shall be in accordance with manufacturer's written installation instructions, code, applicable standards, and best construction practices.

B. Space Verification: Prior to ordering materials verify that adequate space exists to accept the products, and along the installation path. Such verification shall be by direct field measurement of the actual space available and use of manufacturer’s final submittal dimensions. Where the project involves new construction and long lead items and a time schedule not allowing for such direct field measurements, confirm in writing with all trades associated with building the space that adequate room is available. Review maintenance and service access space required and confirm requirements will be met. No submittals shall be made until such space verification work has been performed, and confirmed that adequate space is available. By virtue of making a submittal that Contractor affirms he has completed this verification.

C. Installation Locations: Unless dimensioned locations for items are shown, select the precise location of the item in accordance with the Contract Documents, coordinated with other trades and item connection locations, and subject to the Architect/Engineer's review. No allowances will be granted for failure to obtain the Architect/Engineer's review, failure to coordinate the work, and failure to comply with Contract Document requirements.

D. Replacement and Maintenance: Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance (e.g. coils, heat exchanger bundles, sheaves, filters, bearings, etc.) can be removed. Relocate items which interfere with access or revise item installation location, orientation, or means of access.

E. Building Access Doors: Provide access doors where indicated and where needed to provide access to valves, drains, duct access doors, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown on the drawings. The Contractor shall review all construction details and types and locations of items requiring access to determine quantity and sizes of access doors required.

F. Manually Operated Components: Valves, damper operators, on/off switches, keypads, controls, and other devices which are manually adjustable or operated shall be located so as to be easily accessible by a person standing on the floor. Any such items which are not in the open shall be made accessible through access doors in the building construction. See individual specification sections for additional requirements.

G. Monitoring Components: Gauges, thermometers, instrumentation, and other components which display visual information (i.e. operating conditions, alarms, etc.), shall be located and oriented so as to be easily read by a person standing on the floor. Provide necessary brackets, hangers, remote read devices and accessories as needed. Equipment control panels and graphic displays furnished with equipment (or integral to equipment) shall be located to be easily accessible by a person standing on the floor adjacent to the equipment, and be located between 4-feet and 6-feet above the finished floor.

H. Accessible Installation: If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a location that will result in poor access.

I. Rotating Parts: Belts, pulleys, couplings, projecting setscrews, keys and other rotating parts which may pose a danger to personnel shall be fully enclosed or guarded in accordance with Code, and so as not to present a safety hazard.

J. Equipment Pads: All ground and slab mounted mechanical equipment shall be installed on a minimum 4-inch thick concrete pad, (unless indicated otherwise). Where the largest dimension for any pad exceeds 6 feet provide a 6 x 6 - 10 gauge welded wire fabric reinforcement in the pad (unless noted otherwise).

K. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil plastic tape wrapped at point of contact or plastic centering inserts.

L. Electrical Offsets: Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below electrical panels to structure, and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by code to be more. Such required offsets are typically not shown on the plans but are to be provided per this paragraph. Include in bid offsets for all systems near electrical panels.

M. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each equipment connection and on at least 32-inch centers.

N. Safety Protection: All ductwork, piping and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and reflective red/white self-sticking safety tape. All sharp corners on supports and other installed items shall be ground smooth.

O. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the location of pipe and duct routings and in coordinating all work so that equipment access and a clear maintenance pathway to equipment is maintained. Poor maintenance access will not be accepted. Contractor shall note that in essentially all areas piping and ducts need to run up or down between structural members, necessitating

elbows/fittings/transitions at crosses of ducts/pipes and at all connections to mains and branches

P. Pressure Tests: Maintain documentation of all pressure (or leak) tests performed on systems and submit with project closeout documents. Records shall contain (as a minimum): date of test, system name, description portion of system being tested, method of test, initial and final test pressures (or of measured leakage rates, as applicable), indication of test pass or fail, name and signature of individual performing (or documenting) the test, initials of independent witness of test.

3.3 PAINTING

A. General: Painting shall comply with Division 09 specifications regarding painting. Colors, in all cases, shall be as selected by the Architect/Engineer. Color samples shall be submitted to the Architect/Engineer for approval prior to painting.

B. The following painting shall be provided under Division 20:

1. All exposed metallic surfaces (includes piping, ducts, hangers, conduits, etc.) provided by this Contractor (except equipment with factory finish or items specifically excluded) shall receive one coat of rust inhibiting primer and two (2) coats of selected finish paint.
2. All exposed insulated surfaces provided by this Contractor (except where specifically excluded) shall receive one coat of primer and two coats of selected finish paint.
3. The inside of all ductwork (including visible dampers, roof vents, insulation pins, and any visible metal) behind grilles, registers, diffusers, and louvers shall be painted flat black.

C. Items to be painted under Division 09:

1. Exposed duct work in finished areas.
2. Exterior mechanical equipment.
3. Exposed piping in finished areas.

3.4 PENETRATION PROTECTION

A. Exterior and Watertight Penetrations: Where any work pierces the building exterior (or construction intended to be watertight) the penetration shall be made watertight and weatherproof. Provide all necessary products (e.g. caulking, flashing, screens, gaskets, backing materials, siding, roofing, trim, etc.). Where not detailed or indicated how to install submit shop drawings of the proposed methods. Flashing arrangements shall be per SMACNA Architectural Sheet Metal Manual unless noted otherwise. Caulking alone is not an acceptable means of sealing penetrations.

B. Equipment: Equipment or products located outdoors shall be watertight (except for provisions designed to intentionally accept water and having drain provisions) and shall be designed and intended by the manufacturer to be used outdoors at the project location. Where any work pierces the unit casing exposed to the outdoors the penetration shall be made watertight and weatherproof; provide all necessary products (e.g. caulking, flashing, gaskets, backing materials, etc.).

C. Animal Protection: Mechanical system openings, overhangs, shrouds, coverings, gaps below units, and other elements where animals could enter or occupy shall be protected with screens to prevent animal entry or occupation. Screening shall be installed in a neat professional manner, square to the adjacent construction, and be securely attached with removable fasteners.

3.5 START-UP

A. General: Provide inspections, start-up and operational checks of all mechanical systems and equipment. Maintain documentation of all start-up work and submit with project closeout documents. See individual specification Sections for additional requirements.

B. Personnel: Inspection and start-up services shall be done by individuals trained in the operation, and knowledgeable with, the systems being started-up. Equipment start-up shall be by the manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed detailed start-up schedule with proposed dates and times at least 30 days prior to the earliest proposed system start-up. Revise dates and times as mutually agreed upon with trades involved, and witnesses, before submitting a final start-up schedule.

D. Witnessing: Start-up may be witnessed by the Engineer and Owner's representative (at their option). Notify the Engineer and Owner 7 days prior to the proposed start-up time.

3.6 OWNER INSTRUCTION

A. General: Provide instruction to the Owner on the operation and maintenance of all installed mechanical systems. Prior to instruction provide final Operation and Maintenance (O&M) manuals. Have copy of O&M manual and project drawings on hand during instruction.

B. Personnel: Instruction involving the general arrangement and overview of systems, including locations and connections of system components, shall be by individuals that were involved in the installation of these systems. Instruction on the operation and maintenance of products shall be by individuals trained and experienced in the installation, operation and maintenance of these products. Instruction shall be by the product manufacturer's authorized service representative where indicated (see individual specification Sections).

C. Scheduling and Agenda: Submit a proposed instruction schedule (with proposed dates and times) and an instruction agenda at least 30 days prior to the earliest proposed instruction period. Coordinate Owner and Architect/Engineer review and arrange mutually agreed upon instruction schedule and the instruction agenda, and submit a final instruction schedule and agenda. Organize instruction by sub-systems corresponding to the project specifications (or similar logical grouping).

D. Classroom Instruction:

1. Scope: Provide instruction in a sit-down classroom setting for each mechanical system.

2. Overview: Provide an overview of each system. Explain the overall arrangement of each system; including equipment, fixtures, system features, capacities, isolation valve locations, and utility main connection locations; with appropriate references to drawings.
3. Operation: Explain the operation of each system. Explain normal operation, normal system settings, range of settings, how system adjustments are made, possible failure modes, emergency operation, normal and emergency start/stop procedures, safety concerns, and related information.
4. Maintenance: Explain system maintenance requirements with references to the O&M Manual. Discuss system access methods, required maintenance, maintenance procedures, and frequency of maintenance. Discuss typical repairs. Review any recommended spare parts, special tools, and special knowledge/experience required.
5. Duration: Classroom instruction for overall mechanical systems shall be for a minimum 8 hours; classroom instruction for controls system shall be for a minimum of 8 hours; see specific sections for additional Owner Training requirements.
6. Records: Submit documentation noting names of those receiving the instruction, scope of instruction, date and time of occurrence, and signed by the individuals receiving the instruction. **Video record all instruction and provide 2 CD copies.**

E. Field Instruction:

1. Scope: Provide on-site field instruction for each mechanical product requiring maintenance or expected to require repair in the next 10 year period. Provide individual instruction for each unique product, or where products of the same type vary appreciably from others (due to size, options, etc.). See individual specification sections for additional requirements.
2. Overview: Show and explain the overall arrangement and locations of each mechanical system. Show the locations of all system major shut-off valves, location of major equipment components, routing of system mains, and related information.
3. Operation: Demonstrate and explain normal start-up, normal shut-down, normal operation, normal settings, adjustments, signs of abnormal operation, emergency shut-down, safety concerns, and related information.
4. Maintenance: Demonstrate and explain system maintenance requirements with references to the O&M Manual. Show how maintenance is performed, including how items are accessed, maintenance procedures, tools and parts required, and related information. Review typical repairs and explain how performed.
5. Records: Submit documentation noting names of those receiving the instruction, scope of instruction, date and time of occurrence, and signed by the individuals receiving the instruction. **Video record all instruction and provide 2 CD copies.**

F. Occupant Training: Provide training to building occupants explaining systems and devices that they have access to or control of. Coordinate with Owner and other training activities.

END OF SECTION 200500

SECTION 200519 - PIPING SPECIALTIES FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Thermometers.

B. Pressure Gauges.

C. Strainers.

D. Unions.

E. Flexible Connectors.

F. Test Ports.

G. Access Doors.

1.3 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Submit product information data for all items to be used.

1.4 REFERENCES

A. ANSI Z21.24: Connectors for Gas Appliances.

B. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.39: Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.

D. ASME B40.3 - Bimetallic Activated Thermometers.

E. ASME B40.100 - Pressure Gauges and Gauge Attachments.

F. IFGC: International Fuel Gas Code.

G. IMC: International Mechanical Code.

H. UPC: Uniform Plumbing Code.

1.5 GENERAL REQUIREMENTS

A. Domestic (Potable) Water Systems: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14.

B. System Requirements: Products shall comply with additional requirements cited for the specific systems the products are being installed in; see specific system specification sections.

C. Spare Parts:: Provide one spare thermometer, industrial type for Domestic Hot Water.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Thermometers: Trerice, Weiss, Winters.

C. Pressure Gauges: Trerice, Weiss, Winters.

D. Strainers: Watts, Keckley, Mueller, Sarco, Taco, Paco, Bell & Gossett, Armstrong, Wilkins.

E. Unions: Anvil, Nibco, Watts, Epco, Victaulic, Ward, Jefferson Union.

F. Dielectric Connecters: Victaulic Precision Plumbing Products, Elster Perfection.

G. Flexible Connectors: Universal, Mason, Dormont, OPW, Unisource, Twin City Hose.

H. Test Ports: Autoflow, Flowset, Peterson Equipment.

I. Access Doors: See Section 083113.

J. Escutcheons: Selected by Contractor.

2.2 THERMOMETERS - INDUSTRIAL

A. Type: 7 inch scale, adjustable angle, red reading mercury, industrial thermometer.

B. Construction: Aluminum or polyester case, acrylic plastic or heavy glass window, aluminum face, stem of brass or aluminum construction, with separate brass socket (i.e. thermowell). Bulb chambers tapered to match taper in thermowell to give metal to metal contact. Scale case adjustable over a minimum 180° range, with locking fastener.

C. Stem Length: Stem insertion length approximately one-half of pipe diameter. Where installed on tanks, minimum insertion length is 5". Where installed on insulated piping systems, provide a longer stem thermometer and extended neck socket (thermowell) to extend thermometer base past the insulation.

D. Display: White background with bold black numerals and Fahrenheit degree markings, red reading mercury.

E. Accuracy: Plus or minus 1% of full scale.

F. Ranges: Plus or minus 50% of systems normal operating temperature (at point of measurement), with figure intervals approximately 1/20th of range. For systems with multiple operating temperatures wider ranges may be used to allow the same thermometer type through-out the system.

2.3 PRESSURE GAUGES

A. General: 4-1/2" round dial, stem mounting, black impact resistant phenolic (or fiberglass reinforced polypropylene) flangeless case, white face with black numerals, phosphor bronze bourdon tube rated to minimum 250 psi, brass socket, acrylic window, and 1/4" npt (or 1/2" npt) bottom connection. Shut off cock not allowed (use ball valve). Rated for use with the system pressures and temperatures to be exposed to, but be rated for no less than 250° F. Accuracy shall be 0.5% per ASME B40, 100 Grade 2A.

B. Liquid Fill: Gauges used on pumps and where vibration or pulsation are present shall be liquid filled and be provided with a snubber. Liquid fill shall be suitable for ambient temperatures from 0 to 150° F, and for system temperatures to be encountered.

C. Syphons: Gauges used on steam or steam condensate piping shall have syphons; rated for minimum 500 psi and 400° F.

D. Pressure Gauge Ranges: 0 to 1.5 times systems normal operating pressure (at point of measurement), with numeral figures on 5 psig for gauges reading to 100 psi, and 10 psig on gauges reading to higher values. Except: systems which operate at a vacuum, provide range from 30 to 0 inches mercury vacuum; where measuring differential pressure provide range 1.5 times normal measured pressure.

2.4 STRAINERS

A. Water Systems:

1. Copper Piping Systems 2-1/2” and Smaller: Bronze body, “Y” type, screwed or solder type end connections, 125 lb class (rated 125 psi steam working pressure at 350 deg F minimum) and 400 psi (WOG) rated working pressures at 210 deg F, stainless steel 20 mesh wire screen, and gasketed retainer cap. Reinforce wire mesh with perforated stainless steel sheet for sizes 2" and 2-1/2". Ratio of net free area of screen to pipe free area greater than 3.5. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an “Acceptable Manufacturer” in the hydronic piping system specification section.
2. Copper Piping Systems 3" and Larger: Bronze or ductile iron body, “Y” type, flanged end connections, 150 lb class (rated 150 psi steam working pressure at 400 deg F minimum), brass or stainless steel screen with 3/64" perforations for 3" and 3/32" perforations for larger sizes; with gasketed threaded retainer cap. Ratio of net free area of screen to pipe free area greater than 3. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an “Acceptable Manufacturer” in the hydronic piping specification section.

3. Steel Piping Systems: Ductile iron, cast iron, or carbon steel construction, "Y" type, 250 lb class (rated 250 psi steam working pressure at 450°F minimum), with stainless steel screen. Screen shall be 20 mesh for strainers up to 2" in size, and have 3/32" perforations on larger sizes. Sizes 2-1/2 inch and less shall have threaded end connections; larger sizes shall have flanged end connections. Provide with bolted and gasketed strainer cap on flanged strainers; provide threaded gasketed retainer cap on threaded strainers. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the hydronic piping system specification section.

B. Steam and Condensate Systems: Cast iron or cast carbon steel construction, "Y" type, 250 lb class (rated 250 psi steam working pressure at 450°F minimum), with stainless steel screen. Screen shall be 20 mesh for strainers up to 2" in size, and have 1/32" perforations on larger sizes. Sizes 2-1/2 inch and less shall have threaded end connections; larger sizes shall have flanged end connections. Provide with bolted and gasketed strainer cap on flanged strainers; provide threaded gasketed retainer cap on threaded strainers. Provide with blowdown valve, ball type, with 3/4" NPT male end connection. Valve manufacturer shall be listed as an "Acceptable Manufacturer" in the steam piping system specification section.

C. Air Strainers: "Y" pattern type, iron body, 250 psi working pressure, with 40 mesh Monel screen packed with Everdur wool. Air line strainers shall be fitted with brass blowoff cock.

2.5 UNIONS

A. Dielectric Unions: Shall not be used. Provide "dielectric connector" with standard union where union is required at connection point of dissimilar materials.

B. Unions on Copper Pipe:

1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 125.
2. 2-Inch Pipe and Smaller: Wrought copper solder joint copper to copper union, complying with ASTM B16.18.
3. 2-1/2-Inch Pipe and Larger: Brass flange unions.

C. Unions on Steel Pipe:

1. General: Pressure and temperature ratings to match (or exceed) piping system being installed in; minimum Class 150.
2. Threaded: Malleable iron union, threaded connections, with ground joints, complying with ASME B16.39. Provide with brass-to-iron seat (except provide iron-to-iron seat where the conveyed material is detrimental to brass).
3. Welded and Flanged: Flange unions; see individual system specification sections.

D. Dielectric Connector: Schedule 40 steel pipe nipple, zinc electroplated, with internal thermoplastic lining which is NSF/FDA listed and meeting all code requirements for potable water applications. Suitable for continuous use up to 225 deg F and 300 psi.

"Clearflow" dielectric waterway (or approved). For systems operating at temperatures greater than 225 deg F provide flanged connections with insulating gaskets.

2.6 FLEXIBLE CONNECTORS

A. Piping Flexible Connectors: Corrugated hose type with outer braided wire sheath covering. Corrugations shall be close pitch annular type. Minimum working pressure of 250 psig, minimum length of 12 inches (or 12 times the connector's nominal diameter, whichever is more), and screwed or flanged end connections. Metal for hose shall be bronze or stainless steel; braided sheath shall be stainless steel, any type of ASTM 300 series.

2.7 TEST PORTS

A. Temperature/Pressure Type: Test port for installation in tee in piping allowing insertion of probe for measurement of pressure and/or temperature. Valve shall be of brass construction, have 1/4-inch or 1/2-inch NPT male connection, with dual valves to prevent leakage and gasketed cap with attachment to test port. Rated for minimum 500 psi and 275 deg F. Provide extended length on insulated piping systems so that insulation does not cover the test port.

2.8 ACCESS DOORS

A. See Section 083113 for building access door requirements. Provide stainless steel construction where used in restrooms, locker rooms, kitchens, and similar "wet" areas. Minimum size shall be 12" x 12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

2.9 ESCUTCHEONS

A. Type: Circular metal collar to seal pipe penetrations at building elements (i.e. walls, floors, cabinets, and ceilings); one piece type except that split hinge type may be used for applications on existing piping.

B. Construction: Constructed of chrome plated brass or polished stainless steel, sized to tightly fit pipe exterior surface (or pipe insulation where insulated) and to fully cover the building element penetration.

C. Projection: Shallow face type with maximum projection from wall not to exceed 1.2 times inner diameter of escutcheon.

D. Special Applications: For sprinkler heads and similar special applications see items' specification Section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read.

B. Pressure Gauges: Install pressure gauges at inlet and outlets of all pumps; at each side of pressure reducing valves; and as indicated. Provide with ball-type isolation valves.

C. Strainers: Install strainers ahead of each steam trap, and as indicated. Provide valve in blow-off connection on strainers, valve shall be same size as blow-off tapping.

D. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise. Dielectric unions shall not be used.

E. Dielectric Connectors: Install connectors between all connections of copper and steel piping (or equipment), and other dissimilar metals. Where flanged connections occur use insulating type flanges. Dielectric unions shall no be used.

F. Flexible Connectors - Piping: Install at building expansion joints, and where indicated.

G. Test Ports: Install at locations shown on drawings and where needed by Balancer to allow measurements for flow adjustments.

H. Access Doors: Provide access doors where indicated on the drawings and where needed to provide access to trap primers, water hammer arresters, cleanouts, valves, controls, mechanical spaces, and similar items requiring service or access that would otherwise be inaccessible. Consult architectural drawings and coordinate location and installation of access doors with trades which are affected by the installation. Access doors are typically not shown in the plans. Review ceiling and wall types and locations of items requiring access to determine quantity and sizes of access doors required.

I. Escutcheons: Provide at all pipe penetrations through building elements, except where penetration is concealed (unless specifically noted otherwise). Items located in accessible cabinet spaces (e.g. below sinks) are not considered concealed.

END OF SECTION 200519

SECTION 200529 - HANGERS AND SUPPORTS FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Pipe Hangers and Supports.

B. Duct Hangers and Supports.

C. Mechanical Equipment Anchors and Supports.

1.3 QUALITY ASSURANCE

A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) Standards SP-58, SP-89, SP-69, and SP-90.

B. General: All methods, materials and workmanship shall comply with Code; including IBC, IMC, UPC, NFPA Standards, and ASME standards.

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data: Submit product data for all hangers, supports, and anchors. Data to include finish, load rating, dimensions, and applicable agency listings. Indicate application for all items by system type, size, and other criteria as appropriate to project.

C. Shop Drawings:

1. General: Shop drawings shall clearly indicate dimensions, anchor and support type, anchor and support size, anchor and support spacing, finish, configuration, and systems/equipment to be applied to.
2. Attachments: Submit shop drawings for proposed attachment methods to building structure where the method of attachment has not been shown on the drawings, or where attachment methods other than those shown on the drawings are desired to be used.
3. Fabricated Supports: Submit shop drawings for all fabricated supports.
4. Finished Areas: Submit shop drawings for all supports that will be exposed in finished areas.

1.5 GENERAL REQUIREMENTS

A. Seismic: Provide adequate hangers, supports, anchors, and bracing to serve as seismic restraints. Seismic restraints shall comply with Section 200548. Provide seismic restraint

calculations and information per Section 200548 and as required by code.

B. Design and Manufacture: All pipe hangers and supports shall be designed and manufactured in accordance with MSS-SP 58.

1.6 REFERENCES

A. ADC: Air Duct Council - Flexible Duct Performance and Installation Standard, 5th Edition.

B. ASHRAE-F: American Society of Heating, Refrigeration, and Air Conditioning Engineers, Handbook of Fundamentals.

C. ASME B31.1: Power Piping.

D. ASME B31.9: Building Services Piping.

E. ASTM A36: Standard Specification for Carbon Structural Steel.

F. ASTM A108: Standard Specification for Steel Bar, Carbon and Alloy, Cold - Finished.

G. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM A153: Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

I. ASTM A653: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

J. ASTM A907: Standard Specification for Steel, Wire, Epoxy - Coated.

K. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.

L. IBC: International Building Code.

M. IMC: International Mechanical Code.

N. Mason SRG: Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 6th Edition.

O. MSS SP-58: Pipe and Hangers and Supports - Materials, Design and Manufacture.

P. MSS SP-69: Pipe and Hangers and Supports - Selection and Application.

Q. MSS SP-89: Pipe Hangers and Supports - Fabrication and Installation Practices.

R. MSS SP-90: Guidelines on Terminology for Pipe Hangers and Supports.

S. SMACNA-DCS: HVAC Duct Construction Standards Metal and Flexible, 3rd Edition.

T. SMACNA SRM: Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition.

U. UPC: Uniform Plumbing Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Hangers and Supports: Grinnell, B-Line Systems, Unistrut, Erico, PHD, Basic-PSA, Pate, Caddy, Unisource, Metraflex.

C. Anchors: Rawplug, Phillips, Hilti, Michigan, Simpson, Fastenal, Grinnell, B-Line Systems, Unistrut, PHD, Basic-PSA, Metraflex.

2.2 GENERAL

A. Finish:

1. Indoor Applications: Electro-plated zinc in accordance with ASTM B 633, or hot-dip galvanized after fabrication in accordance with ASTM A 123; except that hanger straps may be formed from pre-galvanized steel.
2. Outdoor Applications: Hot-dip galvanized after fabrication in accordance with ASTM A 123, ASTM A 153, or ASTM A 653 (as applicable to item).

B. Identification: Steel pipe hangers and supports shall be stamped with the manufacturer's name, part number, and size.

C. Hanger Rods: Threaded hot rolled steel. Hanger rods shall be sized so that the total load imposed (including pipe or duct, insulation, hangers, and fluid) does not exceed the following:

Nominal Rod Diameter	Maximum Load
1/4 Inch	240 Pounds
5/16 Inch	440 Pounds
3/8 Inch	610 Pounds
1/2 Inch	1130 Pounds
5/8 Inch	1810 Pounds
3/4 Inch	2710 Pounds
7/8 Inch	3770 Pounds
1 Inch	4960 Pounds

D. Hanger Straps: Galvanized steel, minimum 1" x 22 gauge (except where required by Code to be heavier or noted otherwise), of lock-forming grade conforming to ASTM A924, G90 (minimum) galvanized coating conforming to ASTM A 653. Minimum yield strength of 30,000 psi. Straps shall be sized so that the total load imposed does not exceed the following:

Strap Size	Maximum Load
1” x 22 Gauge	230 Pounds
1” x 20 Gauge	290 Pounds
1" x 18 Gauge	380 Pounds
1" x 16 Gauge	630 Pounds
1-1/2" x 16 Gauge	990 Pounds

E. Concrete Inserts: Malleable iron or steel body designed to be embedded in concrete for attachment to suspended hanger rods. Size to match hanger rod size used with.

F. Beam Attachments: Constructed of malleable iron or steel, MSS standard types designed for clamping to building structural support beam. “C” clamp type shall have cup point set screws with locknuts and retaining straps. Center loaded type beam clamps shall have horizontally adjustable clamping bolt (or rod with nuts).

G. Concrete Anchors: Wedge type expansion anchors, with hex nut and washer, and stainless steel split expansion rings. Tested to ASTM E 488 criteria, UL listed, with exposed anchor head stamped with code to identify anchor length.

H. General Anchors (Screws, Nuts, Bolts, Fasteners):

1. General: Constructed of materials suitable for the conditions exposed to and materials being joined, with minimum 50 year service life. Stainless steel construction where exposed to corrosive conditions. Configuration, size and grade to suit application, accommodate expected forces, and provide anchoring to structural element (or allow for proper fastening of items). Minimum safety factor of 2.5 (or as required by code, whichever is greater). Comply with ASTM A 307, SAE J429, SAE J78, or ASTM A 563; bolts and nuts shall have unified inch screw threads (course, UNC).
2. Test Reports: Provide independent test report indicating fastener strength (pullout and shear) as installed in the materials and applications of this project.
3. Finish: In finished areas, the portion of fastener exposed to view shall match the exposed finish of item being fastened.
4. Vandal Resistant Type: Require unique tool to remove; two-hole spanner type, torx-head type, or equivalent. Coordinate with other trades and use same type through-out project (unless noted otherwise).

I. Manufactured Strut Systems:

1. Channels: Minimum 12 gauge, 1-5/8 x 1-5/8" (unless noted otherwise), with slots/holes to suit application.
2. Accessories: Channel nuts press formed, machined and hardened with gripping slot, fabricated from steel conforming to ASTM A 108 or ASTM A 36. Fittings fabricated from steel in accordance with ASTM A 907.
3. End Caps: Vinyl cap, capable of withstanding high temperatures without degradation, manufactured specifically for use with manufactured strut. Unistrut Series P2859 or P2860 (or approved).

J. Steel: Structural steel per ASTM A 36.

K. Wood: Only allowed to be used where building structural elements are of wood

construction and where located within building construction (e.g. in walls); fire treated. Where located outdoors shall be the pressure treated type; with all cut portions of wood painted with wood preservative.

L. Field Galvanizing Compound: Brush or spray applied galvanizing treatment; consisting of a premixed ready to apply liquid organic zinc compound, with 95% metallic zinc content by weight in dry film. ZRC worldwide "ZRC Cold Galvanizing Compound".

M. Rooftop Equipment Sleepers: Factory fabricated sleepers, constructed of minimum 18 gauge galvanized steel, all joints fully welded, with integral base plate pressure treated top wooden nailer, and integral top flashing having side turndown over wood nailer. Size to suit equipment supported, with minimum height above roof as indicated, and configuration to suit roof and roof insulation used with. Pate Co. "es-Equipment Supports", Thybar "TEMS", (or approved equal).

2.3 PIPE HANGERS AND SUPPORTS

A. Copper Pipe: All hangers used directly on copper pipe shall be copper plated or have a factory applied 1/16-inch thick (minimum) plastic coating on all contact surfaces.

B. Cushion Clamps: Pipe clamps with a vibration dampening insert between the pipe and clamp, with a nylon inserted lock-nut on clamp. Insert shall be constructed of a thermoplastic elastomer, designed to tightly fit and match pipe size and clamp used with; suitable for system temperatures.

C. Type: Shall be MSS type selected in accordance with MSS-69; except that MSS type 24, 26, and 34 shall not be used.

D. Trapeze Hangers: Shall be constructed of carbon steel angles, manufactured strut channels, or other structural shapes with flat surface (or installed saddle) for pipe support. Provide steel washer where hanger rod nuts bear on trapeze hanger. Pipe anchors shall be two piece clamp type designed for use with trapeze style (i.e. inserted into strut channel opening) or one piece type designed for welded or bolted attachment to trapeze; shaped to match pipe size (or pipe size plus insulation thickness on insulated systems). Pipe guides shall comply with paragraph titled "Alignment Guides"; or be steel angles with vertical leg height equal to pipe diameter (or pipe diameter plus insulation thickness on insulated systems); or be two piece clamp type pipe anchors sized and installed to serve as a guide.

E. Insulated Pipe Supports:

1. Insulation material at pipe support shall consist of expanded perlite, calcium silicate or high density phenolic. Insert shall have a flame resistant jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation, with sheet metal shield. Insulation material shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.32 Btu/hr-sf-deg F-inch. Insulation shall be suitable for temperatures and conditions it will be exposed to without degradation over a 30 year life. Assume all steam applications involve superheated steam at 350 deg F.
2. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.

3. Insert shall be same thickness as adjoining pipe insulation, sized to match pipe used on.
4. Minimum insulation and shield lengths, and shield gauge:

Nominal Pipe Diameter In Inches	Insulation Length In Inches	Shield Length In Inches	Minimum Shield Gauge
1/2 to 1	*	4	20
1-1/4 to 3-1/2	6	4	18
4 to 5	9	6	18
6 to 10	9	6	16

* Insert not required; shield at insulation is acceptable.

F. Expansion Joints:

1. General: Type to suit application (i.e. where located in middle of pipe run provide type to accept expansion/contraction in both directions; where installed at end of pipe run provide type to accept pipe expansion/contraction in one direction). Size to match piping installed in. Provide with axial movement as noted, or (where not noted) as Contractor calculated plus 25 percent excess travel, and in accordance with expansion joint manufacturer's sizing recommendations.
2. Systems Below 200 deg F:

   a. Bellows Type - Steel Piping: Corrugated bellows type, suitable for 150 psi working pressure at 380 degree F temperature. Bellows shall be of type 304 or 316 stainless steel construction. Able to accept expansion in either direction longitudinally. Metraflex Series MNLC or MN (or approved).
   b. Bellows Type - Copper Piping: Externally pressurized, packless, bellows type, suitable for 150 psi working pressure at 500 degree F temperature, copper construction. Able to accept expansion in either direction longitudinally. Hyspan Series 8500 (or approved).
   c. Mechanically Coupled Slip Type: Where mechanically coupled joint systems are allowed on steel piping systems; slip type expansion joint providing up to 3-inch axial end movement, with mechanically coupled pipe ends, rated for 150 psi working pressure and 230 degrees F. Victaulic Style 150 (or approved).
   d. Mechanically Coupled Systems: Where mechanically coupled joint systems are allowed, and system expansion/contraction can be accommodated by pipe joints having appropriate end gaps and appropriate quantity of mechanically coupled joints. See Section 232115.

3. Systems 200 deg F and Higher: Externally pressurized, packless, bellows type, suitable for 150 psi working pressure at 380 degree F temperature. Size to match piping installed in with axial movement as noted (or with axial movement in accordance with manufacturer's sizing recommendations with 25 percent excess travel). Bellows shall be of type 304 or 316 stainless steel construction. Provide type to suit application (i.e. where located in middle of pipe run provide type to accept expansion/contraction in both directions; where installed at end of pipe

run provide type to accept pipe expansion/contraction in one direction. Unisource Series EP (or approved).

G. Alignment Guides: Steel "spider" type alignment guides, with anchoring legs. Provide with calcium silicate insulation where used on cold pipe lines. Metraflex “Style IV”, “PG-PRE” (or approved).

H. Pipe Anchors - Expansion: For use on pipe runs having expansion/contraction devices.

1. Contractor Fabricated: Anchors shall consist of riser clamp and welded pipe or steel angles anchored to structure, or similar arrangement (unless indicated otherwise). Provide with calcium silicate insulation insert rated for 900 psi compressive strength, and vapor barrier where used on cold pipe lines.
2. Factory Fabricated: Carbon steel anchors to force pipe expansion into system expansion/contraction devices, with paint finish. Provide with calcium silicate insulation insert rated for 900 psi compressive strength, and vapor barrier, where used on cold pipe lines. Metraflex “PA”, “PAPI” (or approved).

2.4 DUCT HANGERS AND SUPPORTS

A. Hangers: As shown in SMACNA-DCS except that wire shall not be used and all materials used shall comply with these specifications.

B. Vertical Duct Supports at Floor: 1-1/2" x 1-1/2" x 1/8" (minimum) galvanized steel angle and to support ducts, maximum 12 foot on center, and as shown in SMACNA-DCS. For ducts over 30 inches wide provide riser reinforcing with hanger rods between the riser support and riser reinforcing.

C. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA-DCS.

D. Hanger Attachments to Structure: As shown in SMACNA-DCS to suit building construction and as allowed on structural drawings. Provide washers at all fasteners through hanger straps (regardless of SMACNA-DCS allowances). Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.

E. Hanger Attachments to Ducts: As shown in SMACNA-DCS except that wire shall not be used as any form of support or attachment for ducts.

F. Flexible Duct Strap: Woven polypropylene hanging strap, minimum tensile strength of 400 lbs, minimum 1.75-inches wide, designed and intended for flexible duct support.

G. HVAC Support Wire: Steel, minimum 12 gauge, soft-annealed wire, complying with Federal Specification QQ-W-461H, and IBC for support of ceilings and accessories installed in ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. General: Provide all necessary bolts, nuts, washers, fasteners, turnbuckles, hanger rods,

rod connectors, stanchions, wall/roof/floor backing and attachments, bridging between structural members, and any other miscellaneous accessories required for the support and anchoring of all pipes, ducts, and mechanical equipment. All supports, whether from floor, walls, or hung from structure, are Contractor's responsibility. Anchors and supports shall be adequate to accommodate forces equipment will be exposed to. Any field cut pieces of galvanized materials shall be hot-dip galvanized after cutting; or be solvent and wire brushed clean and receive field applied galvanizing treatment. Field applied galvanizing shall be multiple coats to provide as near equal protection as possible to factory (or hot-dip) applied coatings.

B. Backing: Install steel or wood backing in walls (anchored to studs) and in ceiling (anchored to joists or trusses), as required to provide support for items.

C. Installation: Install all inserts, anchors, and supports in accordance with manufacturer's instructions, code requirements, and best professional practices. The most restrictive criteria governs.

D. Welded Assembly Finish: All welded steel support assemblies shall have a power wire brush and primer paint finish.

E. Attachments: Attach to building structure (or concrete pads) as shown on drawings (reference structural drawings). Where not detailed on the drawings, the Contractor shall design and submit shop drawings of proposed attachment methods to the Engineer for review.

F. Application:

1. Where not detailed on the drawings (or otherwise indicated), the selection and design of supports is the Contractor’s responsibility, in compliance with code and Contract Document requirements; subject to submittal review and acceptance by the Engineer.
2. Exposed supports in finished areas shall be arranged to minimize their visibility; be free of dents, scratches and labels, and be configured in a manner to match the decorum and finish of the room they are installed in. Exposed supports in finished areas shall be cleaned to allow for field painting (unless a chrome, stainless steel, or similar finish has been indicated).
3. HVAC Support wire and flexible duct strap shall only be used for support of ceiling air inlets and outlets, or at flexible duct supports.

G. Manufactured Strut (“Unistrut”): Provide end caps on all exposed ends to prevent personnel injury and where exposed to view.

H. Seismic: Provide bracing and added supports to restrain movement in a seismic event. Items serving as seismic restraints shall comply with Section 200548.

I. Building Structural Loads: Where installed items incur loads that exceed the building’s structural capacity (i.e. the carrying capacity as indicated on the drawings or otherwise noted in the documents), provide support types to transmit the loads to floors or other parts of structure that can carry load (e.g. bridging between joists to distribute load, added structure between walls to allow walls to carry load, etc.). Such supports shall consist of all welded steel angle iron supports, pipe columns, or similar custom fabricated items.

Provide with base plates, U bolts, or similar type accessories to allow proper anchoring and seismic hold-down for all items supported. Maximum spans between supports may be significantly less than the maximum spans allowed by code or by manufacturers due to limitations of allowable loads on building members; reference limitations indicated on the drawings (or otherwise noted in the documents); the most restrictive criteria governs.

3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. General: Aboveground pipe shall be anchored to the structure to prevent sagging, to keep pipe in alignment, and to resist the forces the pipe will be exposed to; piping shall be supported independent of equipment so that no loads bear on the equipment. Underground pipe shall be evenly supported in trenches with proper bedding materials; see Section 200590.

B. Adjustment: All pipe supports shall be provided with a means of adjustment for the aligning and leveling of the pipe after installation.

C. Applications: Selection, sizing, and installation of pipe supports and accessories shall be in accordance with the manufacturers recommendations, standards MSS SP-89 and MSS SP-69, UPC, and IMC. Refrigerant piping and similar piping subject to vibration (i.e. high pressure tubing) shall be installed with cushion clamps.

D. Support Spacing: Provide piping support spacing according to the most restrictive of the following: UPC, IMC, ASME B31.1, B31.9, local codes, manufacturers recommendations or Contract Documents specific requirements. Provide supports at each change in direction of piping and at each side of concentrated loads (such as in-line pumps, valves greater than size 5", and similar items). On hubless cast iron piping provide supports at each branch connection; and hubless cast iron piping greater than size 2" shall have supports on both side of piping couplings.

E. Trapeze Hangers: Four or more pipes running parallel may be supported on trapeze hangers provided the slopes of such pipes allow use of common trapeze. Suspend trapeze hanger from the building structure using hanger rods; attach to the building structure using concrete inserts, beam clamps, or other approved methods. Where trapeze width exceeds 30 inches, and where building attachment restrictions require more anchor points, provide three (or more) hanger rod supports. Provide pipe anchors to secure piping to trapeze on minimum 20 foot spacing; size and install pipe anchor to allow longitudinal movement of pipe (unless noted otherwise) with minimal vertical and transverse movement; where pipe is subject to expansion/contraction provide anchoring and alignment guides per paragraph titled “Thermal Expansion/Contraction”.

F. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required so that hanger spacing does not exceed allowable spacing and as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable support. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure on two sides of drop to provide rigid anchoring of pipe drop. Provide riser clamps and vertical supports on all vertical vent piping where the vertical pipe length exceeds 5'.

G. Underground Pipe: Shall be evenly supported on approved bedding materials, as

appropriate for the type of piping being used. Such bedding and backfilling shall be as specified in Section 200500.

H. Thermal Expansion/Contraction:

1. General: All expansion devices and associated system features to accommodate pipe thermal expansion/contraction shall be Contractor designed (except where a specific design has been provided), in accordance with MSS SP-69, ASME B31.9, ASME B31.1, ASHRAE-F, and expansion joint manufacturer's guidelines. See Section 200548 for requirements to accommodate building movement and system vibration.
2. Locations: Where straight pipe runs exceed 50 feet in length, and where piping is subject to expansion and contraction of 1/2-inch lengthwise or more, provide expansion joints or expansion loops (use specific type where indicated) to accommodate system expansion/contraction.
3. Expansion: Unless expansion/contraction lengths have been indicated, calculate expansion contraction using worse case temperatures system will be exposed to (e.g. installed seasonal temperature of system versus high/low operating temperature, or system high/low operating values, etc.) and pipe expansion factors from ASHRAE-F.
4. Supports, Guides, Anchors: Pipe shall be supported with roll type or anti-friction plate type supports to allow movement relative to expansion devices without imparting movement to hangers; brace hangers as needed in order to prevent movement. On systems operating below 125 deg F roll type or anti-friction plate type supports are not required provided the required expansion/contraction can be accommodated by direct movement of the pipe (or pipe insert) on the installed supports. Provide alignment guides on each side of expansion devices and at intermediate points to maintain pipe alignment as recommended by alignment guide manufacturer. Provide pipe anchors at the end of runs to ensure pipe expansion into expansion devices.

3.3 INSTALLATION OF DUCT HANGERS AND SUPPORTS

A. General: Provide anchors and supports for all ductwork. Supports and hangers shall comply with SMACNA-DCS, except that hanger spacing and hanger maximum loads shall be governed by whichever is more restrictive between these specifications or SMACNA-DCS.

B. Hanger Spacing -- Rectangular Duct:

Duct Area	Maximum Spacing
Up to 4 Square Feet	8 Feet
4.1 to 10 Square Feet	6 Feet
10 Square Feet and Up	4 Feet

C. Hanger Spacing -- Round Duct:

Duct Area	Maximum Spacing
Up to 24 Inch Diameter	8 Feet
25 Inch to 48 Inch Diameter	6 Feet
49 Inch Diameter and Up	4 Feet

D. Hanger Spacing - Flexible Duct: 4 feet, and at changes of direction as needed to maintain duct elevation and smooth airflow.

E. Vertical Ducts: Support at each floor level, but in no case less than on 12 foot intervals.

F. Flexible Duct: Support with methods shown in ADC. Metal strap in contact with the flexible duct shall have minimum 1.5-inch width.

G. Fittings: Provide supports at each change in direction of duct for ducts with 4 square foot area or more, or for ducts larger than 24 inch diameter. Locate hangers at inside and outside corners of elbows--or at each end of fitting on each side.

H. Concentrated Loads: Provide additional supports at each side concentrated loads such as modulating dampers (24" x 24" and larger), duct heaters (18" x 18" and larger), sound attenuators (all sizes), and similar items.

I. End of Duct: At end of duct run, hangar shall be located no more than 1/2 the allowed hangar spacing from the end of the run.

3.4 CEILING SERVICES

A. Less than 20 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners (or ceiling support members) or to cross runners with the same carrying capacity as the main runners (or support members).

B. 20 to 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing 20 pounds but not more than 56 pounds, in addition to the above, shall have two No. 12 gauge wire hangers (or minimum 1” x 22 gauge hangar straps) connected from the terminal or service to the ceiling system hangers or to the structure above. These added hangers may be slack.

C. Greater Than 56 Pounds: Ceiling mounted services, air inlets/outlets, and accessories weighing more than 56 pounds shall be supported directly from the building structure by approved hangers.

3.5 MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

A. General: Provide anchoring and supports for all mechanical equipment. All equipment shall be anchored to (or supported from) the building structure. In lieu of anchoring to the building, anchor outdoor equipment to the concrete pad serving the equipment.

B. Suspended Equipment: Support as indicated on the plans. Where not indicated use the methods shown (or consistent with) Mason SRG and SMACNA-DCS; submit shop drawings of the proposed methods to the Engineer for review.

C. Roof Mounted Equipment: Install on roof curbs or roof sleepers as indicated. Anchor equipment to the curb (or sleeper), with the curb (or sleeper) in turn anchored to the building structure.

D. Vibration Isolation: Equipment shall be supported and anchored in such a way so that no

equipment vibration is transmitted to the building structure.

E. Seismic: Provide anchors and bracing to resist seismic forces.

END OF SECTION 200529

SECTION 200530 - SLEEVES AND SEALS FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Pipe Sleeves.

B. Duct Sleeves.

C. Duct Closure Collars.

D. Firestop Seals.

E. Non-Firestop Seals.

1.3 DEFINITIONS

A. Firestop System: Specific firestop materials or combination of materials installed in a specific way in openings in a specific rated assembly to restore the fire rating and smoke resistance properties of the assembly.

B. Firestop Seal: Same as “Firestop System”.

C. Rated Assembly: Wall, floor, roof, ceiling, roof/ceiling or other construction which is required (by code or the Contract Documents) to have a fire-resistance rating or to be a smoke barrier.

1.4 SUBMITTALS

A. General: Shall comply with Section 200500.

B. Product Data: Provide product data on all material to be use. Provide MSDS for all sealants, caulks and similar materials.

C. Shop Drawings – General: Shop drawings of proposed sealing/flashing assembly for roof and exterior wall penetrations.

D. Shop Drawings – Firestop: Provide firestop system shop drawings showing:

1. Listing agency’s detailed drawing showing opening, penetrating items, and firestop materials. Drawing shall be identified with listing agency’s name and number or designation, fire rating achieved, and date of listing for each firestop system.
2. Identify where each firestop system is to be used on the project.

3. Manufacturer's installation instructions.
4. For proposed systems that do not conform strictly to the listing, submit listing agency's drawing marked to show modifications and stamped approval by the firestop system manufacturer's fire protection engineer.
5. Other data as required by the AHJ.

1.5 REFERENCES

A. ASTM A 36: Standard Specification for Carbon Structural Steel.

B. ASTM C534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

C. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

D. ASTM E 814: Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. UL 1479: Standard for Fire Tests of Through-Penetration Firestops.

F. UL 723: Surface Burning Characteristics of Building Materials.

G. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, Third Edition.

H. SMACNA-ARCH: SMACNA Architectural Sheet Metal Manual, Seventh Edition.

I. USGBC LEED: US Green Building Council LEED Reference Guide for Green Building Construction.

1.6 GENERAL REQUIREMENTS

A. Corrosion Protection: All sleeves exposed to water, moisture, chemicals, or subject to corrosion shall be constructed of corrosion resistant materials suitable for the exposure. Steel sleeves shall be hot dip galvanized after assembly. Provide additional coatings as noted or as required to resist corrosion.

B. All adhesives, sealants, mastics and similar materials shall be low-VOC type, and comply with USGBC LEED requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Firestop Seal Materials: 3M, Dow Corning.

C. Non-Firestop Seal Materials: 3M, GE, Dow Corning, Tremco, Pecora, Sonneborn, Pipeline Seal & Insulator.

2.2 PIPE SLEEVES

A. Diameter:

1. Belowground: Inside diameter of belowground pipe sleeves shall be at least 2 inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.
2. Aboveground: Inside diameter of aboveground pipe sleeves shall be at least 1-inch larger than the outside diameter of the pipe or pipe covering (for covered piping systems), so as to allow free movement of piping.
3. Large Movement: Provide larger sleeves where a larger space around pipe exterior is required by code, where specifically noted, where expansive soils or other unusual conditions are present and where required to accommodate large piping movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the final floor elevation.

C. Structural Type: Fabricated from schedule 40 steel pipe. Waterstop shall consist of fully welded 2-inch larger diameter collar, minimum 1/4 inch thick steel, located on sleeve so as to be centered within the element being penetrated. Provide waterstop on sleeves where sleeves are installed in the following locations: in cast-in-place concrete, where any part of the sleeve ends are exposed to water, where installed in floors with water-proofing or water stopping membranes, in rooms with floor drains, and where needed for anchoring/support purposes. Prime paint all surfaces with rust-inhibiting paint.

D. Non-Structural Type:

1. Belowground Type:

a. Non-Waterstop Type: Fabricated from any of the following: 18 gauge galvanized sheet metal, 22 gauge spiral seam galvanized steel duct, schedule 40 PVC, HDPE thermoplastic or Schedule 40 galvanized steel pipe.
b. Waterstop Type: Constructed of HDPE thermoplastic or Schedule 40 steel pipe, with waterstop. Waterstop shall consist of 2-inch larger diameter collar, minimum 1/4 inch thick, located on sleeve so as to be centered within the element being penetrated, fully welded (for steel) or bonded/formed (for HDPE) to sleeve. Sleeve shall be suitable for use with “Link-Seal” type seal. Prime paint all surfaces with rust-inhibiting paint.

2. Aboveground Type:

a. Non-Waterstop Type: Fabricated from 18 gauge galvanized sheet metal or 22 gauge spiral seam galvanized steel duct. Provide with galvanized steel angle tabs, collars, or similar to allow for anchoring where sleeve cannot be retained in place by element being penetrated.
b. Waterstop Type: Fabricated from 18 gauge galvanized sheet metal or 22 gauge spiral seam galvanized steel duct. Cold galvanize cut edges of sleeve. Waterstop shall be constructed of same material as sleeve, be

fully welded to sleeve, 2-inch larger diameter, located on sleeve to allow sealing of gap between sleeve and element being penetrated.

E. Flexible Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type 1, minimum 1/2-inch thick. Water vapor permeance shall not exceed 0.08 perms. Operating Temperature Limits -20 degrees F to 180 degrees F. Provide in sheet or pre-fabricated pipe size; provide multiple wraps as required.

2.3 DUCT SLEEVES

A. Size: Inside dimension of duct sleeves shall be at least 1-inch larger than the outside dimension of the duct or duct covering (for covered duct systems). For duct system conveying air or gases operating above 200 deg F provide sleeve dimension minimum 2-inch larger than duct or duct covering (for covered duct systems). Provide larger sleeves where a larger space around duct exterior is required by code, by duct or flue system manufacturer, to provide required thermal clearances, where specifically noted, where unusual conditions are present and where required to accommodate large movement.

B. Length: Horizontal sleeves through finished areas (where sleeve is exposed to view) shall be sized to be flush with finished surfaces; other horizontal sleeves may terminate flush to 2-inches past the element being penetrated. Vertical sleeves shall be sized to extend one inch above the finished floor.

C. Structural Type: Fabricated from schedule 40 steel pipe for round openings and 3” x 3” x 3/8” welded steel angles for other openings (unless noted otherwise). Prime paint all surfaces with rust-inhibiting paint.

D. Non-structural: 24 gauge spiral seam galvanized steel duct or 20 gauge longitudinal seam galvanized steel duct for round openings. Fabricated of 18 gauge galvanized sheet metal for other openings; configured to suit duct.

E. Flexible Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type 1. Water vapor permeance shall not exceed 0.08 perms. Operating Temperature Limits -20 degrees F to 180 degrees F. provide in sheet or pre-fabricated pipe size.

2.4 DUCT CLOSURE COLLARS

A. General: Closure collars shall provide closure of opening between duct and opening in element penetrated and shall abut tight up to and overlap duct and shall consist of rolled angle material (for round ducts) and welded framed angles (for rectangular and round ducts).

B. Size: Closure collars shall be sized to match duct and opening applied to and shall have minimum 2-inch overlap on duct side and 2-inch overlap at opening/penetrated element side but shall completely cover opening in element penetrated with minimum 1-inch overlap to undisturbed element (i.e. wall, floor, etc.).

C. Material: Closure collars shall be fabricated of 20 gauge galvanized steel for ducts 15 inches diameter and less and shall be fabricated of 18 gauge galvanized steel duct for all larger ducts and all square and rectangular ducts.

2.5 FIRESTOP SEALS

A. General: Commercially manufactured through-penetration and membrane-penetration firestop systems to prevent the passage of fire, smoke and gases, and to restore the original fire-resistance rating of the barrier penetrated.

B. Listing: Firestopping shall be listed by UL in “Fire Resistance Directory” (category to match the application), or be qualified by another independent agency acceptable to the AHJ.

C. Rating: Firestop system and devices shall be tested in accordance with ASTM E 814 or UL 1479, with “F” and “T" ratings as required to maintain the fire-resistance rating of the barrier penetrated, and as required by code.

D. Fire Hazard: Materials shall have a flame spread of 25 or less, and a smoke development rating of 50 or less; when tested in accordance with ASTM E 84 or UL 723.

E. Cabling Applications: Firestop systems used with loose electrical cabling shall be the type that allows for removal of the cable or installation of new cables without damage to the firestop system, or the need to replace or repair firestop materials.

F. Insulation: Firestop system shall be applicable to insulated systems to allow the insulation to run continuous through the firestop system (unless noted otherwise).

2.6 NON-FIRESTOP SEALS

A. Indoor Sealants:

1. Dry Areas: Single component, latex sealant complying with requirements of ASTM C834. Sealants shall be of the following types, or approved equal:

   a. Tremco Corporation “Tremflex 834”.
   b. Pecora Corporation “AC-20 Arylic Latex”.
   c. Sonneborn Building Products “Sonolac”.

2. Wet Areas: Single component, mildew resistant silicone sealant complying with requirements of ASTM C920, Type S, Grade NS, Class 25. Color white. Sealants shall be of the following types, or approved equal:

   a. Dow Corning “786 Mildew Resistant Silicone”.
   b. Pecora Corporation “898 Silicone Sanitary Sealant”.
   c. Tremco “Tremsil 200”.

B. Outdoor Sealants:

1. General: Single component, non-sag, low modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 100/50. Sealant shall be of the following types, or approved equal.

   a. Dow Corning “790 Silicone Building Sealant”.
   b. Pecora Corporation “890 Silicone”.

c. Tremco “Spectrem 1”.

2. Adjacent to Aluminum: Single component, non-sag, medium modulus, silicone elastomeric sealant conforming to requirements of ASTM C920, Type S, Grade NS, Class 50. Sealant shall be primer-less type for use in joints adjacent to fluoropolymer coatings. Sealants shall be of the following types, or approved equal:

a. Dow Corning “795 Silicone Building Sealant”.
b. GE Silicones, Momentive, SCS2000 and SCS7000.
c. Pecora “895 Silicone”.
d. Tremco “Spectrem 2”.

C. Expanding Foam Sealant:

1. General: Single component, polyurethane insulating sealant with flame spread index of 25 or less and smoke development rating of 50 or less. Shall expand and fully cure within 24 hours to a semi-rigid, closed cell, water and air resistant foam. Sealant shall be of the following types, or approved equal.

a. DAP “Kwik Foam”.
b. Fomo Products ”Handi-Foam”.
c. Todol Products “EZ Flo Gun Foam”.

D. Full Water Immersion Sealant: Polysulfide or Polyurethane; ASTM C920, M or Type S, Grade NS, Class 25, uses M and A; approved by manufacturer for “continuous water immersion”, single or multi-component.

1. Tremco “Vulkem 116”.
2. Sonneborn “Sonalastic Polysulphide Sealant”.

E. Link Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute water-tight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Pipeline Seal and Insulator, "Link-Seal" (or approved).

F. Specialty: Packed fiberglass or wool insulation; with silicone sealant rated for use with temperatures and other conditions encountered.

PART 3 - EXECUTION

3.1 PIPE SLEEVES

A. General: Provide sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements. Except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drilled opening are provided. Sleeves shall be the following type (horizontal/vertical refer to position of sleeve):

1. Horizontal, Belowground:

a. Belowground on Both Sides of Element Penetrated: Non-structural, belowground, non-waterstop type; except that penetrations of footings shall be structural type.
b. Belowground on One Side of Element Penetrated: Structural type.

2. Horizontal, Aboveground:

a. Concrete and Masonry Walls: Non-structural aboveground non-waterstop type.
b. Other Walls: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as sleeve would provide (see specified sleeve size).

3. Vertical, Slab on Grade: Structural type; except at piping serving individual fixtures or individual heating units in finished areas, the flexible type may be used. Where not installed to be concealed (as in a plumbing chase) install height of flexible type so it is concealed by the floor finish, cabinet base, or an escutcheon.
4. Vertical, Not Slab on Grade:

a. Concrete Floors/Roofs: Structural type where not concealed; non-structural aboveground type where concealed.
b. Other Floors/Roof: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as a sleeve would provide (see specified sleeve size

B. Installation: Set sleeves plumb or level (or sloped as required for sloped pipes) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surfaces (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.2 DUCT SLEEVES

A. General: Provide sleeves for all ducts passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required at core drilled penetrations through solid concrete or where formed openings equivalent to a core drill and provided and where no floor drain serves the room where the penetration occurs. Sleeves shall be the following type aboveground:

1. Horizontal:

a. Concrete and Masonry Walls: Non-structural aboveground type.
b. Other Walls: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes).

2. Vertical:

a. Concrete Floors/Roofs: Structural type where not concealed; non-structural aboveground type where concealed.
b. Other Floors/Roof: No sleeve required unless needed as part of the seal system or specifically noted to be provided (i.e. for acoustic, thermal, seal retention, or other purposes). Provide clearances around pipe same as a sleeve would provide (see specified sleeve size).

B. Installation: Set sleeves plumb or level (or sloped as required for sloped duct) in proper position, tightly fitted into the work. Set sleeves properly in element for specified projection past adjacent surface (see sleeve product specification); cut ends of sleeve as necessary.

C. Insulation: Insulation shall run continuous through sleeves (unless noted otherwise).

3.3 DUCT CLOSURE COLLARS

A. General: Closure collars shall be provided for all exposed ducts on each exposed penetration where the duct passes through any floors, walls, ceilings, roofs, partitions, and similar elements. Closure collars shall additionally be provided where so noted on the drawings and at all duct penetrations into mechanical rooms, boiler rooms, and rooms housing mechanical equipment (on both sides of the penetration).

B. Installation: Collar shall be installed tight against surfaces and shall fit snugly around the duct or duct covering. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier of insulated ducts. Collars shall be anchored to element penetrated, with fasteners appropriate to material fastening to, on maximum 6 inch centers.

3.4 FIRESTOP SEALS

A. General: At each through-penetration and membrane-penetration in rated assemblies, provide a firestop system. Firestop system shall be installed in accordance with the manufacturer's instructions, listing, and as required by code.

B System Selection: Contractor is responsible to select the firestop systems to be utilized, corresponding to the construction of the assembly penetrated, and types of penetrations for this project. Contractor shall submit proposed firestop systems to be utilized, shall also review such systems with the AHJ and obtain AHJ approval.

C. Preparation: Prepare surfaces as recommended by firestop material manufacturer. Examine and confirm that conditions are acceptable to proceed with the installation. Provide maskings and temporary coverings to prevent contamination or defacement of adjacent surfaces.

D. Installation Review:

1. Notify Architect/Engineer when firestopping work is complete and ready for review. Provide minimum 7 days notice to allow scheduling of review. An independent testing agency may be utilized to perform an inspection.

2. Notify AHJ when firestopping work is complete and ready for inspection. Provide sufficient advance notice to allow scheduling of the inspection without adversely impacting project schedule.
3. Do not cover or conceal firestopping until all inspections have been satisfactorily completed.

3.5 NON-FIRESTOP SEALS

A. General: Provide seals around all ducts, conduit, and piping passing through sleeves, walls, floors, roofs, foundations, footings, partitions, and similar elements. Seals shall be watertight where the penetration may be exposed to water or moisture. Provide type of sealant to suit the application.

B. At Sleeves:

1. Between Sleeve and Penetrated Element: Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating and properties that allow a tight seal between the sleeve and the surrounding construction. Seal full depth of sleeve for vertical penetrations.
2. Between Pipe and Inside of Sleeve: Provide sealant between outside of pipe or pipe covering (for covered piping systems) and inside of sleeve. Seal depth shall be minimum 1-inch each side. Provide Link Seal type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations (not required where flexible type sleeves are used).

C. No Sleeves: Provide “Link-Seal” type for belowground penetrations, vault wall penetrations, and slab-on-grade penetrations. Provide sealant at other areas, type to suit the application. Fully seal between outside of pipe or pipe covering (for covered piping systems) and surrounding construction. Seal depth shall be minimum 1-inch each side.

D. Plumbing Fixtures: Provide sealant between fixture and abutting building surfaces. Seal so no water or overspray from fixture can enter building construction. See Section 224000.

E. High Temperature Systems: On piping systems operating above 200 deg F, use “Specialty” seal; pack full depth of penetration with silicon type sealant applied 1/2-inch depth over packing, each end.

F. Preparation: Remove loose materials and foreign matter impairing adhesion of seal. Perform preparation in accordance with recognized standards and sealant manufacturers recommendations. Protect elements surrounding area of work from damage or disfiguration due.

G. Installation: Install sealants immediately after joint preparation. Install sealants free of air pockets, foreign embedded matter, ridges, and sags. Tool exposed joint surface concave and with a neat finished appearance.

END OF SECTION 200530

SECTION 200548 - VIBRATION AND SEISMIC CONTROLS FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Vibration Isolation.

B. Seismic Restraints.

1.3 DEFINITIONS

A. "Equipment" is defined to mean any item with power connections (fans, HV units, AHU units, etc.), and also to include all hoods; but does not include pumps less than 3 hp.

B. "Equipment Requiring Vibration Isolation" is defined to be any equipment (as defined above) with rotating components (e.g. pumps, fans, etc.).

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data:

1. Submit product data on all items to be used.
2. Submit calculations showing vibration isolation selection for all isolation devices provided under this specification section (i.e. where isolation is not furnished integral with the equipment or by the manufacturer of the equipment).

C. Shop Drawings: Submit shop drawings for all fabricated support assemblies.

D. Submit calculations showing seismic restraint calculations, restraint selection, proposed locations of all seismic control bracing, and details of bracing construction.

1.5 GENERAL REQUIREMENTS - VIBRATION ISOLATION

A. General:

1. Select and provide all vibration isolation devices for all equipment requiring vibration isolation so as to provide complete installed mechanical systems free of the transmission of vibration and vibration generated noise to the structure.
2. Vibration isolation is shown on the drawings for various items but is not shown for all items requiring isolation. Provide all isolation as indicated and specified herein.

B. Supplier: Where not provided by the equipment manufacturer, all vibration isolation devices and support assemblies shall be supplied as a coordinated package by a single vibration isolation manufacturer, under this specification section.

C. Equipment Manufacturer Items: Isolation devices furnished by equipment manufacturer shall comply with this specification section and be selected by the manufacturer to suit, and provide satisfactory performance, for the applications of this project.

1.6 GENERAL REQUIREMENTS - SEISMIC RESTRAINTS

A. General: Mechanical equipment, piping, and ductwork seismic restraints are typically not shown on the drawings but are to be provided as specified herein. Contractor is responsible to select and provide all seismic anchoring devices for all mechanical equipment, all piping, and all ductwork.

B. Domestic (Potable) Water Systems: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14.

C. Seismic Restraint Systems:

1. The Contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint system and perform seismic calculations in accordance with the state and local codes and additional requirements specified in this section. Calculations, restraint selections, and installation details shall be done by a professional experienced in seismic restraint design and installation and licensed in the State where the project is located.
2. The seismic design, consisting of calculations, restraint selection, installation details, and other documentation, shall be submitted. This submittal shall be signed and sealed by a professional Engineer (where required by code).
3. The seismic restraint design shall clearly indicate the attachment points to the building structure and all design forces (in X, Y, and Z direction) at the attachment points. The seismic restraint engineer shall coordinate all attachments with the building's structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed.
4. The seismic restraint design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of seismic, weight, and other loads imposed.
5. Analysis should include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis should detail anchoring methods, bolt diameter, embedment, and/or welded length. All seismic restraint devices should be designed to accept, without failure, the forces detailed above in "Identification of Application Codes" in this chapter.
6. Forces shall be calculated in accordance with accepted engineering practice, using appropriate seismic "zone" and other factors for the building type and location.

1.7 REFERENCES

A. IBC: International Building Code.

B. IMC: International Mechanical Code.

C. MASON: Mason Industries Seismic Restraint Guidelines for suspended piping, Ductwork, Electrical Systems and Floor Mounted Equipment, 2005 6th Edition.

D. OSHPD: Office of Statewide Health Planning and Development, State of California, Fixed Anchorage.

E. SMACNA/SRM: Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition.

F. UPC: Uniform Plumbing Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Products: Mason, Peabody, Kinetics Noise Control, Vibration Eliminators, Amber-Booth.

C. Expansion Devices/Flexible Connectors: Unisource Manufacturing, Twin City Hose, and as specified in Section 200519, and 233300.

2.2 NEOPRENE ISOLATORS

A. Isolation Pads: Oil resistant bridge bearing neoprene pads, minimum 3/4-inch thick, with cross-ribbed or waffle design. Size pads for not more than 50 psi or as recommended by vibration isolator manufacturer. Provide load distribution plates (minimum 3/8" plate steel) to evenly load pads. Mason Type SW (or approved).

B. Floor Mounted Isolators: Double deflection neoprene mounts, sized for minimum deflection of 0.30-inch. All metal surfaces shall be neoprene covered, base plate shall have mounting holes, and top shall have threaded steel plate or threaded steel insert. Element shall be color coded or labeled with molded symbols to identify capacity. Neoprene shall be bridge bearing type. Mason Series ND (or approved).

C. Suspension Isolators: Double deflection neoprene type, with isolator encased in open steel bracket, and sized for minimum 0.30-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD (or approved).

D. Washer Bushings: Bridge bearing neoprene washer insert to provide isolation between anchor bolt and washer from support member/equipment. Mason Series HG (or approved).

2.3 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection not less than 1-inch (unless noted otherwise), except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2-inches (unless noted otherwise). Floor isolator springs shall have deflection of not less than 1-inch. All isolators shall provide at least 95% isolation efficiency. Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved; provided that a written explanation is submitted for Engineer review and approval.

B. Floor Type Spring Isolators: Open spring type with ratio between spring diameter divided by compressed spring height no less than 0.8. A ribbed neoprene acoustical friction pad shall be bonded to the underside of the isolator. Shall have bolted connections for rigid attachment to equipment, configured to allow for equipment leveling by bolt adjustment. Provide with height saving bracket. Mason Series SLF (or approved).

C. Floor Housed Type:

1. Ductile Iron: Housed spring isolator with ductile iron housing, base plate with mounting holes, spring inspection ports, neoprene cushion, adjustable upward rebound plate. OSHPD pre-approved. Provide with mounting brackets to suit equipment connected to. Mason Series SSLFH (or approved).
2. Welded Steel: Housed spring isolator with welded steel housing, steel base plate with mounting holes, number of springs to suit application, neoprene vertical limit stops, spring bottom neoprene acoustical cups, bottom non-skid neoprene friction pad, and equipment attachment configuration to suit equipment served. OSHPD pre-approved. Provide with mounting brackets to suit equipment connected to. Mason Series SLR or SLRSO (or approved).

D. Suspension Type Spring Isolators: Shall consist of a rigid steel frame with a stable steel spring in the bottom part of the frame, and double deflection neoprene (or rubber) isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than one-half rod diameter shall be provided all around the rod and neoprene bushings provided to prevent steel to steel contact. Mason Series DNHS or Series 30N (or approved).

E. Vibration Isolating Roof Curbs-HVAC Equipment Applications: Shall be type as specified in the equipment specification section; where not indicated may be of either style specified:

1. Curb Mount: Separate spring mounted curb for mounting on top of HVAC unit manufacturer's standard curb, with size, configuration, and capacity to suit equipment served. Shall be of extruded aluminum construction, with welded corners and supporting members, and electro-plated steel spring isolators. Spring isolators shall provide minimum 1" deflection, with minimum 50% travel to solid, spring diameter shall be no less than 0.8 of the spring height at the rated

load. Spring isolators shall be sized by vibration isolation curb manufacturer to suit equipment weight served. Curb shall have internal resilient snubbers and suitable clearances to accommodate unit movement under normal wind forces (up to 35 mph) without hindering normal spring action. Curb shall remain captive under anticipated maximum seismic and wind forces, unless an exterior anchoring means is utilized. Curb shall be designed with top member overlapping the bottom member to allow for water runoff, and shall have a flexible EPDM continuous perimeter weather seal between these two members. Where unit length exceeds 10 feet, unit may be shipped in sections with a field splice kit to join sections; splice kit shall include overlapping EPDM and overlapping top and bottom members. All hardware shall be cadmium or zinc electroplated. Assembly shall have self adhering closed cell sponge gasketing, to be applied between curb and vibration isolation assembly, and between vibration isolation assembly and HVAC equipment.

2. Direct Roof Mount: Roof curb with integral spring isolators; size, configuration, and capacity to suit equipment served; and providing unit seismic restraint. Lower curb portion shall of steel construction, with horizontal base leg, integral wooden nailer, and removable electro-plated spring isolators. Spring isolators shall provide minimum 1-1/2" deflection, with minimum 50% travel to solid and spring diameter no less than 0.8 of the spring height at the rated load. Spring isolators shall rest on 1/4" thick neoprene pads. Spring isolators shall be sized by curb manufacturer to suit equipment weight served. Upper curb portion shall consist of a galvanized steel frame, to provide continuous support of equipment and transfer unit weight to spring isolators. Upper curb portion shall remain captive under anticipated maximum seismic and wind forces. Curb shall have internal resilient snubbers and suitable clearances to accommodate unit movement under normal wind forces (up to 35 mph) without hindering normal spring action. Curb shall have a continuous galvanized flexible counter flashing joined at corners with EPDM bellows. Lower curb portion shall have provision to accept 2-inch thick rigid insulation. Curb shall include an inner steel frame attached to curb upper "floating" section sized to match equipment duct connection openings to match up to unit and facilitate field duct connections to unit. Curb shall include seismic restraint reinforcing and calculations by a structural engineer licensed in the State of the project location showing forces imparted from the unit to the curb and from the curb to the roof structure per the requirements of this Section.

2.4 SEISMIC RESTRAINTS

A. General: Comply with code, SMACNA-SRM and MASON.

B. Materials:

1. Steel shall be per ASTM A36; hangers and other devices shall be per Section 200529 and as shown in SMACNA-SRM or MASON. Sheet metal used for bracing shall be no less than 16 gauge. Material for straps shall be galvanized steel, no less than 18 gauge.
2. Cabling: Cables shall be minimum 1/8" diameter, 7 x 19 strand, galvanized steel with clear vinyl coating. Provide with galvanized thimble, clamps, and accessories. End termination and clamping/application shall comply with SMACNA-SRM.

C. Flexible Connectors:

1. Piping Systems:

a. Flexible Connectors: As specified in Section 200519.
b. Seismic “V” Connectors: "V" design connector with braided hose and attachment fittings. Shall be constructed of type 321 stainless steel hose and braid with carbon steel elbows and ends (for steel piping systems); and bronze hose and braid with copper elbows and ends (for copper piping systems). Unit shall allow for 2" movement in all planes, and have minimum 150 psi working pressure at the system temperature installed. Unisource Manufacturing (or approved).

2. Ductwork: Flexible connectors as specified in Section 233300.

PART 3 - EXECUTION

3.1 VIBRATION ISOLATION

A. General: Provide vibration isolators for all rotating equipment so that no vibration is transmitted to the structure. Isolators shall be the type indicated; except where not shown, type shall be as selected by vibration isolation manufacturer (or equipment manufacturer) to provide adequate isolation.

B. Installation: Install all vibration isolators in accordance with isolator manufacturer's instructions and isolated equipment manufacturer's recommendations.

C. Inadequate Isolation: Should vibration isolators prove inadequate to prevent transmission of vibrations to the building structure or limit equipment vibration generated noise, such isolators shall be replaced with isolators having the largest deflection that can be practically installed or otherwise modified/replaced to produce satisfactory isolation. Such replacement shall be at no additional cost to the Owner.

D. Equipment with Rotating Components not Requiring Isolation:

1. In-line pumps.
2. Split system ductless air conditioning and heat pump units; indoor portion.
3. Grade mounted condensers.
4. Rooftop curb mounted fans.

3.2 SEISMIC RESTRAINTS

A. General: Provide seismic restraints as required by code and as specified. Comply with SMACNA-SRM, and MASON. Anchoring system and restraints shall be able to withstand anticipated seismic forces. Coordinate with equipment manufacturers for proper equipment anchor attachments to withstand anticipated forces. Coordinate with project structural engineer for attachment of seismic restraints to building.

B. Piping: Longitudinal and transverse bracing shall be required for all piping 2-1/2-inch diameter and larger and on all fuel gas piping 1-inch and larger. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 40 feet, except on fuel gas piping on maximum intervals of 20 feet.
2. Longitudinal bracing shall occur at maximum intervals of 80 feet, except on fuel gas piping on maximum intervals of 40 feet. Transverse bracing for one pipe section may also act as a longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 2 feet of the elbow or tee of similar size. Piping conveying fluids at 100 degrees F and higher shall have expansion devices provided in-between longitudinal braces to allow for thermal expansion.
3. Bracing may be omitted when the top of the pipe is suspended 12 inches or less from the supporting structural member and the pipe is suspended by an individual hanger.

C. Ductwork: Longitudinal and transverse bracing shall be required for all round ducts 28 inches in diameter and larger, for rectangular ducts 6 square feet and larger, and on all duct systems used for life safety and smoke control installed in either the horizontal or vertical position. Bracing shall be applied as follows:

1. Transverse bracing shall occur at maximum intervals of 30 feet (20 feet for essential facilities), at each duct turn and at the end of a duct run.
2. Longitudinal bracing shall occur at maximum intervals of 60 feet (40 feet for essential facilities). Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it, if bracing is installed within 4 feet of the intersection and sized and installed on the larger duct.
3. Groups of ducts may be combined in a larger size frame using overall dimensions and maximum weight of ducts. At least two sides of each duct must be connected to the angles of the brace.
4. Walls, including non-bearing fixed partitions which have ducts running through them, may replace a transverse brace.
5. For non-essential facilities bracing may be omitted when the top of the duct is suspended 12 inches or less from the supporting structural members and on roof top ductwork.

D. Equipment:

1. Equipment Not Requiring External Vibration Isolation:

   a. General: Shall be rigidly connected to the structure per Section 200529. Restraints (where required) shall utilize welded steel frames, steel braces, straps, or cables. Provide elastomeric (or neoprene) pads (1/4" thick) between seismic straps and equipment.
   b. Base Mounted Equipment:

      1) Provide anchorage per Section 200529 and bracing as needed to maintain equipment anchorage with anticipated seismic forces.
      2) All equipment shall have seismic bracing where the height of the equipment is 3 or more times the smallest base dimension and where the equipment anchorage alone is not adequate to maintain equipment anchorage with anticipated seismic forces.

3) All water heaters shall have seismic bracing. Boilers and equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have shall have seismic bracing where the equipment anchorage alone is not adequate to resist anticipated seismic forces.

c. Other Equipment: All equipment located 31" or more from the point of attachment to the supporting structure shall have seismic bracing. Equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have seismic bracing.

2. Equipment with External Vibration Isolation:

a. General: Restraints shall not impede operation of vibration isolators, and shall use methods complying with SMACNA-SRM or MASON.

b. Base Mounted Equipment:

1) All equipment shall have seismic bracing where the height of the equipment is 3 or more times the smallest base dimension and where the equipment vibration isolation components are not adequate to maintain equipment in place with anticipated seismic forces.

2) Provide housed spring isolators, seismic snubbers, padded welded steel angle restraint assembly (with minimum 1/4" clearance between pad and equipment), or slack cable restraints.

c. Other Equipment:

1) All equipment located 31" or more from the supporting structure shall have seismic bracing. Equipment which utilizes (or contains) flammables, combustibles, or hazardous materials shall have shall have seismic bracing.

2) Utilize slacked cable bracing to accommodate equipment movement due to vibration isolator operation but installed so as to prevent more than 2-inch movement in any direction.

E. Bracing Arrangements:

1. Do not use branch ducts or piping to brace main runs or consider as braces for equipment.

2. Do not brace items to dissimilar parts of a building or dissimilar building systems that may respond in a different mode during an earthquake. (Examples: wall and roof, solid concrete wall and lightweight roof, existing building structure and new isolated building structure.)

3.3 TEST AND INSPECTION

A. Field Inspections: Prior to initial operation, the vibration isolators and seismic devices shall be inspected for conformance to drawings, specifications, and manufacturer's data and instructions. Check all flexible connectors/expansion devices for proper location, guiding, and end anchoring.

B. Vibration Isolator Inspection: After installation of isolators and seismic restraint devices, remove all shipping blocks and other items that may prevent proper isolator operation. Inspect isolators to verify that the machinery moves freely on its spring isolators within limits of stops or seismic restraint devices. Eliminate or correct interferences.

C. Tests: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels. Re-balance, adjust, or replace machinery with noise or vibration levels in excess of those given in the machinery specifications or machinery manufacturer's data. Check for proper operation of expansion devices and associated items during system warm-up.

END OF SECTION 200548

SECTION 200590 - UNDERGROUND UTILITIES EXCAVATION AND FILL FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Excavation

B. Trenching.

C. Shoring and Trench Protection.

D. Bedding.

E. Backfilling.

F. Compaction.

G. Verification of Existing Utilities.

H. Protection of Utilities.

I. Dewatering.

J. Identification Warning Tape.

1.3 DEFINITIONS

A. “Utility Bedding” is defined to mean “material placed beneath the utility for utility support, and material placed adjacent to the utility to the centerline of the utility.”

B. “Utility Zone Backfill” is defined to mean “backfill material that is placed in the area from the centerline of the utility up to the specified height above the top of the utility, and is located above the utility bedding and below the final backfill material.”

C. “Trench Backfill” is defined to mean “backfill material that is placed above the utility zone backfill, and up to rough or finished grade.”

D. “Unstable Material” is defined to mean “material that depresses more than 1/4-inch under a load of 2000 pound/square foot, is not firm and stable, or in any way appears incapable of supporting the loads to be imposed.”

1.4 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground mechanical utilities work will be performed, and not proceed with work until unsatisfactory conditions have been corrected.

B. Codes and Standards: Comply with all applicable codes and standards.

C. Experience: Only contractors fully experienced and entirely knowledgeable in the type of work required shall work on this project. By providing bids for this project the Contractor is acknowledging that he has such expertise, and will staff the project with personnel experienced and knowledgeable in the work to be performed.

D. Compaction Testing: Contractor shall provide testing to confirm that the specified compaction levels are being met. Contractor shall keep a record of the location and results of such tests, name of individual performing, and how performed, and have the records on site for Engineer and Owner review. The Owner will retain their own Special Inspector to perform tests (at their discretion) to confirm contract compliance. Notify the Owner of work schedule and coordinate with the Special Inspector to accommodate inspections and tests.

1.5 GENERAL REQUIREMENTS

A. Safety: Contractor is solely responsible for worker safety and for selecting and designing all trench shoring methods, trench protection methods, site utility protection means and other aspects of the work. All such means, methods, and safety measures shall comply with applicable codes and standards, and the requirements of the Contract Documents.

B. Coordination: Coordinate all work with other trades. Coordinate with other Divisions the location and termination of all work of other trades and interconnections with Division 15 work.

C. Scheduling: Schedule work to avoid impacts to other trades due to open trenches, dewatering, and other activities.

D. Existing Utilities: Verify location of all existing utilities that lay in the route of intended work. Verify the location of all existing utilities that will be connected to prior to beginning work for any new utilities.

E. Discrepancies: Notify the Architect/Engineer of any discrepancies or conflicts within the Contract Documents or between the Contract Documents and field conditions. Do not proceed with any work or purchasing of any materials for the area(s) of conflict until obtaining written instruction from the Architect/Engineer on how to proceed. Any work done after discovery of such discrepancies or conflicts and prior to obtaining the Architect/Engineer's instructions on how to proceed, shall be done at the Contractor's expense. In case of a conflict between Divisions 20 requirements and other project requirements, the most stringent and expensive (as judged by the Architect/Engineer) shall prevail.

1.6 REFERENCES

A. ASTM D 1557, Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. ASTM D 2487, Soils for Engineering Purposes (Unified Soil Classification System).

C. WSDOT Standards: Washington State Department of Transportation, Specifications for Road, Bridge, and Municipal Construction, 2014 Edition.

PART 2 - MATERIALS

2.1 GENERAL MATERIALS

A. General: All materials used for bedding, backfill, and drainage purposes shall be free of debris, roots, wood, vegetation, refuse, soft unsound material, frozen material, deleterious or other objectionable material.

B. Sand: Clean, free flowing, coarse grade sand, as defined by ASTM D 2487.

C. Pea Gravel: 3/8-inch washed pea gravel; durable particles composed of small, smooth, rounded stones or pebbles meeting the following for grading and quality:

Sieve Size	Percent Passing (By Weight)
1/2" square	100
3/8" Square	85-100
5/8" Square	50-100
U.S. No. 4	10-30
U.S. No. 8	0-10
U.S. No. 16	0-5

2.2 BEDDING MATERIALS

A. Standard: Gravel backfill material, with characteristics of size and shape to allow for compaction, no dimension exceeding 1-1/2 inches, and meeting the following for grading and quality:

Sieve Size	Percent Passing (By Weight)
1-1/2" Square	100
1" Square	75-100
5/8" Square	50-100
U.S. No. 4	20-80
U.S. No. 40	3-24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

(Based on WSDOT 2014, 9-03.12 (3))

B. Special: Pea gravel or sand (per paragraph titled “General Materials”).

C. Bedding Material Application:

Utility	Bedding Material	Minimum Thickness*
Cast Iron Piping	Standard (or Special)	4"

Steel Piping/Conduit	Standard (or Special)	4"
Ductile Iron Piping	Standard (or Special)	4"
Plastic Piping/Conduit	Special	4"
Copper Piping	Special	4"
Conductors/Cable	Special	4"

* Below bottom of utility (unless noted otherwise).

2.3 UTILITY ZONE BACKFILL MATERIALS

A. Standard: Same as specified for standard bedding materials.

B. Special: Minus 3/8"-inch washed gravel, or sand.

C. Utility Zone Backfill Material Application:

Utility	Backfill Material	Minimum Thickness**
Cast Iron Piping	Standard (or Special)	4"
Steel Piping/Conduit	Standard (or Special)	4"
Ductile Iron Piping	Standard (or Special)	4"
Plastic Piping/Conduit	Special	4"
Copper Piping	Special	4"
Conductors/Cable	Special	4"

** Above top of utility (unless noted otherwise).

2.4 PIPE TRENCH BACKFILL

A. Standard: Gravel backfill material, with size and shape to allow for compaction, no dimension exceeding 3 inches, and meeting the following:

Sieve Size	Percent Passing (By Weight)
2-1/2" Square	75-100
U.S. No. 4	22-100
U.S. No. 200	0-10
Dust Ratio	2/3 max.
Sand Equivalent	30 min.

(Based on WSDOT 2014, 9-03.19, modified for 2-1/2" Sieve size).

B. Satisfactory Native Material: Excavated material from trenching (or other excavation on site), complying with 2.1 A., having no clods or rocks greater than 3 inches in any dimension.

C. Material Application: Either standard or satisfactory native materials may be used (unless noted otherwise).

2.5 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. General: Polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines. Tape shall be minimum 6" wide, acid and alkali resistant.

B. Detectable Type: Minimum 0.004 inch thick, with integral wire, foil backing, or other means to allow detection of tape location. Encase metallic element in protection jacket or other means to provide corrosion protection.

C. Non-Detectable Type: Minimum 0.003 inch thick.

D. Labeling: Tape shall be imprinted with bold black capital letters continuously and repeatedly over the entire tape length. Warning shall read "CAUTION BURIED (utility type) BELOW" or similar wording. Lettering identifying the utility type shall match as closely as possible the designation noted on the plans. Tape lettering shall be permanent and be unaffected by moisture or other materials contained in trench backfill.

E. Tape Colors:

Utility	Color
Electric	Red
Water	Blue
Sewer	Green
Storm	Green

PART 3 - EXECUTION

3.1 GENERAL

A. Shoring and Trench Protection: Contractor is responsible to design and provide all necessary trench shoring and trench protection to:

1. Provide safe conditions.
2. Provide conditions that comply with applicable codes and AHJ requirements.
3. Prevent undermining of pavement, foundation, slabs, utilities, and other structures.
4. Prevent movements in adjacent slopes or banks.

B. Workmanship: Work shall abide by best professional practices as described in referenced standards, and as recognized by accredited professionals.

C. Compaction: Provide compaction to percent indicated per ASTM D 1557, of laboratory maximum density. Compact to 95 percent (unless noted otherwise). Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

D. Grading: Provide grading to prevent surface water from flowing into areas of work to maintain the stability of the work area, and suitable working conditions.

E. Dewatering: Provide dewatering system for the collection and disposal of surface and subsurface water encountered during construction in order to maintain conditions suitable

for the work. Provide all pits, drainage conveyances, pumps, dikes, etc. as required to accomplish the work.

F. Underground Utilities: Location of utilities indicated is approximate. Verify the location of all existing utilities prior to beginning work; utilize field electronic detection equipment, pipe cameras, visual site surveys, and careful exploratory digging at key locations. Coordinate with other trades routing and locations of all new utilities to avoid conflicts and ensure proper connections.

G. Machinery and Equipment: Movement of construction machinery and equipment over buried and backfilled pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged. Pressure testing of piping before final Owner acceptance is required to verify no damage has occurred.

H. Protection: Protect all areas of work from traffic, erosion, weather, settlement or other damaging effects. Protect all existing utilities from damage.

I. Jacking, Boring and Tunneling: Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored or tunneled if the utility can be safely and properly installed and backfill can be properly tamped in such sections.

J. Buried Warning and Identification Tape: Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade. Provide detectable type over non-metallic piping systems. Piping systems installed within the building footprint does not require identification tape.

3.2 EXCAVATION - GENERAL

A. General: Provide all excavation as necessary to allow for the work indicated. Excavations for underground mechanical structures shall be sufficient to provide a minimum of 12 inches clearance between their surfaces and the sides of the excavation.

B. Excavated Material:

1. Stockpiles: Stockpile materials satisfactory for backfilling in an orderly manner at a safe distance from the excavation to avoid overloading the sides of the excavated area and to prevent slides or cave-ins.
2. Protection: Protect stockpiles from contamination with unsuitable backfill materials. Provide adequate drainage at stockpiled areas to prevent water retention in material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.
3. Disposal: Excavated material not required or not satisfactory for backfill or other uses on site shall be removed and disposed off site.

3.3 TRENCH EXCAVATION

A. General: Excavate trenches to accommodate utility, required utility slopes, depths of connecting utility, existing and new utilities, required cover depth, and site conditions.

B. Removal of Unsuitable Material:

1. Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed by over excavation of the trench bottom 4 inches below the depth otherwise required. Contractor is responsible for reviewing the soils report and overall site conditions and, for all costs associated with removal and replacement of unstable materials. For bidding purposes, assume that a minimum of 10% of all excavated bottom utility bearing areas will have unstable material.
2. Rocks and Stones: Stones of 6 inches or greater in any dimension, and any rock or stone of any size/orientation that may disrupt the pipe bedding thickness or pipe supports shall be removed. Rock shall be removed to 4 inches below the bottom of the pipe bearing elevation. Review soils report and Civil drawings notes for special rock conditions that exist.
3. Other: Any wood, refuse, waste, organic material, or other material which would adversely affect pipe support shall be removed. For bidding purposes, assume that 5% of all trench bottom area will have objectionable material as described in this paragraph.
4. Replacement Material: Replace removed unsuitable material with "Utility Foundation Material" as specified under paragraph titled "General Backfill Materials", or with bedding material specified for the piping to be placed in the trench.

C. Bottom Preparation: Bottoms of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe (or other utility) after bedding placement, and proper slope of piping.

D. Depth: Trench shall be adequate to provide a minimum depth of cover required to meet connecting utilities; but minimum depth as follows:

1. Water Lines: 3.0 feet (or deeper if required by the AHJ); except that branch piping to fixtures within the building footprint shall have a minimum of 1 foot of cover.
2. Other: As required to meet connecting utilities; but minimum 1 foot of cover (unless indicated otherwise).

3.4 BEDDING

A. Pipe Bedding: Provide even bedding placement along the entire length of the pipe to support pipe on a uniformly dense unyielding foundation, without load concentration at joint collars or bells. Bedding shall be installed and compacted prior to installing pipe. Bedding located beneath piping shall have minimum thickness specified in Part 2 of specifications, and be compacted to 90% maximum density. Recesses shall be excavated as necessary at each joint or coupling to eliminate point bearing and to allow uniform pipe support by the bedding material the entire pipe length. Haunching shall be installed in maximum 4 inch lifts, hand placed and carefully worked under the pipe haunches and then compacted to 90% maximum density. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

3.5 BACKFILLING

A. General: Provide backfill of all trenches and underground mechanical structures to grade. Provide adequate initial backfill to allow proper pressure tests, and inspections by AHJ and Architect/Engineer. Leave joints and couplings uncovered as necessary to discover pipe leaks. Do not conceal underground utilities until AHJ and Architect/Engineer have reviewed utilities.

B. Utility Zone Backfilling: Backfill shall be placed in loose layers and compacted to 90 percent maximum density. Backfill shall be placed in horizontal layers no more than 6-inches thick. Backfill shall be brought up simultaneously on each side of the utility to the top of the utility, and onto the specified height above the utility (see Part 2 of specifications). Backfill and compact in a manner to avoid damaging or disturbing the completed utility.

C. Pipe Trench Backfilling: Backfill above the pipe zone backfill shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. Where pipe is outside the building footprint, backfill shall be placed in horizontal layers no more than 6 inches thick and compacted to 95 percent maximum density. Where pipe is inside the building footprint, backfill shall be placed in horizontal layers no more than 6 inches thick and be compacted to 85 percent maximum density.

D. Other Utility Backfill: Backfill shall be accomplished in such a manner that the utility will not be shifted out of position nor damaged by impact or overloading. Backfill shall be placed in horizontal layers no more than 6 inches thick and be compacted to 95 percent maximum density.

END OF SECTION 200590

SECTION 200593 - TESTING, ADJUSTING, BALANCING FOR MECHANICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Air Balancing.

B. Plumbing System Water Balancing.

C. Report.

1.3 SUBMITTALS

A. General: Comply with Section 200505.

B. Company: Submit name of Company proposed to do the balancing and sample balancing forms. Where the Company has not been pre-qualified, and substitutions are allowed after bidding (see Division 00 and 01), submit information regarding firm qualifications.

C. Personnel: Submit list of personnel that will be assigned to the project and their qualifications, and list of past projects.

D. Reports: Preliminary and final balancing reports.

1.4 REFERENCES

A. AABC-NS: Associated Air Balance Council, National Standards for Field Measurements and Instrumentation.

B. ASHRAE: Handbook of Fundamentals.

C. ACGIH-IV: American Conference of Governmental Industrial Hygienists, Industrial Ventilation, A Manual of Recommended Practice.

D. NEEB-PS: National Environmental Balancing Bureau Procedural Standard for Testing, Adjusting and Balancing Environmental Systems.

1.5 GENERAL REQUIREMENTS

A. General: Balancing shall be done by a company which specializes in this type of work and is totally independent and separate from the Company which has installed the systems to be balanced.

B. Balancers Qualifications:

1. General: Work of this Section shall be performed by balancing firms meeting the following and having prior approval from the Engineer:

    a. Professional Affiliation: Firm shall be an Associated Air Balance Council (AABC) member balancer or National Environmental Balancing Bureau (NEBB) certified balancer.
    b. Experience: Firm shall have satisfactorily completed the balancing work for at least 5 similar projects in the last 3 years. Similar is defined to mean: within 10% of the same quantity of units and air inlets/outlets, involve same type of systems, be the same type of facility (i.e. school, hospital, etc.). The lead field balancer (i.e. the individual who will be on site directing and participating in the balancing efforts) shall have at least 5 years of experience performing balancing work on similar projects.
    c. References: Have five references for similar projects which have been completed in the last three years that will give a good or better performance rating. References shall be engineers, architects, or building owners. As part of the qualification process at least three of these references will be contacted and a rating obtained for the following: timeliness of work (i.e. able to complete work on schedule), cooperative nature of balancer's staff (i.e. ability to work well as a team with other project trades and professionals), overall quality of balancing work, quality of balancing report. Each item will be rated on a scale of 1 to 5 (5 being excellent), with the result averaged, score must be of 4 or better.

2. Pre-Qualified Balancers: As a convenience to the Contractor, the following balancing firms have been pre-qualified. This is not in any way intended to limit competition or prevent other firms from submitting qualifications, but is intended as an aid to Contractors by identifying firms that have been confirmed as meeting the qualification requirements.

    a. Neudorfer Engineers
    b. Hardin and Sons
    c. Airtest Company
    d. TAC Testing & Commissioning Services

3. Qualification Process: Firms not pre-qualified who desire to perform the balancing work shall submit a substitution request form in accordance with Contract Document requirements (reference Division 00 and 01). In addition to the information required on the substitution request form, submit: Company information, resumes of staff to be assigned, lists of projects, and references (with name of project, staff assigned to project, and contact name and phone number).

C. Balancing Issues: Notify the Engineer in writing of all problems or discrepancies between actual conditions and what design documents show as work proceeds.

D. Engineer's Authority: The Balancer shall be directly responsible to the Engineer and shall perform this work and make system adjustments as directed by the Engineer.

E. Lead Balancer: The Balancer shall assign an individual as "lead balancer" to work in the

field to directly supervise the balancing work and field technicians. This lead field balancer shall have at least 5 years of experience performing balancing work on similar projects.

F. Added Site Visit: The Balancer shall include in his bid three extra site visits and associated time to access system readiness for balancing and resolution of balancing issues. Include added site visit and 8 hours of field balancing time, plus report amendment time to provide added balancing as directed by the Engineer. Such work may occur during the project's construction period or during the warranty period.

G. Commissioning: See Division 01 and Section 20 08 00 for commissioning efforts required by the Balancing Contractor.

PART 2 - PRODUCTS

2.01 GENERAL INSTRUMENTATION

A. General: Balancing equipment shall comply with Associated Air Balance Council recommendations for field measurement instrumentation.

B. Calibration: All measuring instruments shall be accurately calibrated and maintained in good working order. Calibration dates and certifications shall be available at Engineer's request.

C. Instruments: Shall be capable of:

1. Air velocity instruments, direct reading in feet per minute with 2% accuracy.
2. Static pressure instruments, direct reading in inches water gauge with 2% accuracy.
3. Tachometers, direct reading in revolutions per minute with 1/2% accuracy; or revolution counter accurate with 2 counts per 1,000.
4. Thermometers, direct reading in degrees Fahrenheit with 1/10 of a degree accuracy.
5. Pressure gauges, direct reading in feet of water or psig with 1/2% accuracy.
6. Water flow instruments, direct reading in feet of water or psig with 1/2% accuracy suitable for readout of balancing valve provided.

D. Potable Water: Instruments used in contact with potable water shall be cleaned and disinfected before use with a chlorine solution.

PART 3 - EXECUTION

3.01 GENERAL

A. Workmanship: All measurements and adjustments shall be in accordance with AABC-NS, NEEB-PS, and ACGIH-IV and recognized best balancing procedures. Measurements and adjustments of equipment shall be executed in a manner consistent with the manufacturer's recommendations.

B. Flow Rates:

1. General: All air and water systems shall be completely balanced and adjusted to provide the flow rates indicated (within tolerances indicated in this specification Section), and to produce an even heating and cooling effect and control response and to produce even water circulation.
2. Balancer Determined: Where flow rates have not been indicated the balancer shall determine such flow rates using acceptable practices in accordance with AABC-NS, NEEB-PS, and ASHRAE standards and submit the proposed flow rates to the Engineer for review.
3. Confirmation: Prior to beginning balancing confirm any flow rate changes since design with the submittals and flow rates indicated therein, and with the Engineer to confirm changes made since design. Assume that new flow rates will be issued.

C. Controls: Consult and coordinate with the Control Contractor for the adjustment and setting of all control devices to allow for the balancing work, and for proper system operation and proper flow rates. Set all controls and valves as required to maintain design flow rates and temperatures as shown on the drawings. Make measurements and provide data to the Control Contractor to allow for proper control of items.

D. Comfort Adjustments: Make final adjustments for flow rates in order to optimize each space's comfort, including such considerations as temperature, drafts, noise, pressurization, and air changes. Where variances are made from design values, state reasons in report (e.g., "too noisy", "too drafty," etc.). All such variances are subject to approval by the Architect/Engineer.

E. Deficiency Reports: Submit deficiency reports where the work does not allow balancing to occur or balancing issues develop. Indicate date, system and equipment involved, location, description of deficiency, and related information to allow for diagnosing the problem. Provide suggestions for resolution where possible.

3.02 AIR BALANCING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that clean filters have been installed, that system is free from debris, and that all inlets/outlets are not obstructed.
2. Check all fans and equipment to verify that proper start-up and system preparation has been done by the installing contractor.
3. Check all door/window and similar building opening status to insure building is ready and proper pressurization can be obtained.
4. Open all dampers to full flow position, check positions and operation of all motorized dampers to allow full system flows.
5. Review controls and sequences of operation.

B. Tolerances: All air flow rates (supply, return, and exhaust) shall be adjusted to within plus 5 percent and minus 5 percent of the values shown in the contract documents, except that relative space-to-space pressure relationships shall always be maintained (e.g., restrooms shall be negative relative to other areas, general offices shall be positive, etc.).

C. Draft and Noise Adjustments: All diffusers, grilles, and registers shall be adjusted to

minimize drafts and to eliminate objectionable noise.

D. Filters: Air balancing shall be done with new, clean air filters installed. Adjust air deliveries so that design quantities will be obtained when filters are half dirty. This condition shall be simulated by covering a portion of the filter area.

E. Fan Speeds and Drives:

1. Adjust fan speeds and fan drives (adjustable sheaves) as required to produce design flow rates.
2. Where new sheaves are required, calculate sizing of new sheave and coordinate requirements with the Division 23 Contractor for Division 23 Contractor to furnish the new sheave. Replace existing sheave with new one furnished by the Division 23 Contractor; include bid costs for sheave replacements on all belt driven fans.
3. Adjust belts for proper tension.

F. Marking: Upon completion of flow readings and adjustments permanently mark the balanced position of all balancing valves by stamping the indicator plate of the valve.

G. Duct Traverse: Rectangular duct traverses shall measure the center of equal areas in the air flow stream, with centers not more than 6 inches apart. Round duct traverses shall measure at least 20 locations, with locations being the centers of equal annular area. Reference ACGIH Industrial Ventilation Manual.

H. One Open Run: Balance each branch run so that there is at least one wide open run; balance branches relative to one another so that at least one branch damper is wide open (except that where unique conditions exist, and the Engineer gives prior approval, one open damper on runs or branches is not required).

I. Data: Data to be measured/recorded and provided in report for all air handling systems and equipment:

1. Floor plans clearly showing and identifying all diffusers, grilles, OA louvers, ducts and all other items where air flow rates were measured.
2. Identify manufacturer, model number, size, and type of all air inlets/outlets.
3. Initial, trial, and final air flow measurements for all diffusers, grilles, OA louvers, ducts, and all other items where air flow rates were measured.
4. Design air flow rates and percentage final air flow rates are of design values.
5. Final damper (or other balance device) final position (as a percentage of full open).
6. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all fan motors.
7. Initial and final RPMs of all fans.
8. Static pressures on inlet and outlet of all fans.
9. Fan initial and final CFMs.
10. Outdoor air CFMs (record minimum and maximum values).
11. Entering and leaving air temperatures across coils with coils operating at 100% capacity.
12. Static pressure drop across each filter bank and coil.
13. Final position of any speed controls (as percent of full).

14. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).
    b. Service.
    c. Equipment manufacturer and model number.
    d. Sheave and belt sizes (where applicable).
    e. Filters sizes and quantities (where applicable).
    f. Motor manufacturer and complete nameplate data.
    g. Design operating conditions.
    h. Actual operating conditions (flows, pressure drops, rpm, etc.).

J. Main Duct Airflows: Air flow measurements in main ducts shall be made with a duct traverse using a pitot tube and micromanometer. Summation of air terminal outlets and inlets is not sufficient. Quantity of duct leakage (difference between main duct airflow and sum of air inlets/outlets) shall be indicated.

3.03 WATER BALANCING - PLUMBING

A. Pre-check of System: Prior to beginning balancing, perform, as a minimum, the following:

1. Verify that all strainers have been cleaned.
2. Examine fluid in system to verify system condition; balancing is to occur before system disinfection but with system in adequate clean condition.
3. Check for proper rotation and operation of all pumps.
4. Verify that expansion tanks are not air bound and properly charged and that system is full of fluid.
5. Remove air from the circulating system by opening all fixture valves to full flow position allowing system to flow.
6. Check equipment for proper start-up and system operation.
7. Review controls and sequences of operation.

B. Tolerances: All water flow rates shall be adjusted to within plus 10 percent and minus 10 percent of the values shown in the contract documents (or as determined by the balancer where not indicated).

C. Domestic Hot Water Systems: Balance domestic hot water system to provide even flow distribution to allow hot water to reach all fixtures. Use only clean instruments on system and perform balance prior to sterilizing of system. Where flow rates are not indicated, proportion pump water flow rate based on the linear footage of system served.

D. Marking: Upon completion of flow readings and adjustments permanently mark all settings of balancing valves.

E. Data to be measured/recorded and provided in report:

1. Floor plans or schematics showing and identifying all valves, coils, pumps and other items where temperatures, pressure drops, or water flow rates were measured.
2. Identify manufacturer, model number, size and type for all balancing devices.

3. Initial, trial, and final water flow measurements (pressure drops, temperatures, and GPMs) for all items where measurements were made.
4. Design water flow rates, and percentage final water flows are of design values.
5. The connected voltage and corresponding nameplate full load amps, and the initial and final amperages of all pump motors.
6. Pump operating suction and discharge pressures and final total developed head.
7. Pump initial and final GPMs.
8. Final position of all valves (percent open or setting position on valve).
9. Final position of any speed controls (as percent of full).
10. In addition to data noted elsewhere, provide the following for all equipment which are part of balanced systems:

    a. Equipment name and number (as used on drawings).
    b. Service.
    c. Equipment manufacturers and model number.
    d. Equipment capacities.
    e. Motor manufacturer and complete nameplate data.
    f. Design operating conditions.
    g. Actual operating conditions (flows, pressure drops, etc.).

3.04 BALANCING REPORT

A. General: A balancing report shall be submitted as specified herein, documenting all balancing procedures and measurements.

B. Report Organization: The report shall be divided into logical sections consistent with the building or system layout (i.e. by floors, building wings, air handling units, or other convenient way). Tabulate data separately for each system. Describe balancing method used for each system.

C. Preliminary Report: Two preliminary review copies of the balancing report shall be submitted to the Architect/Engineer when the balancing work is 90% complete (or as near 90% complete as possible due to uncompleted work of other trades). In addition to containing all the information required of the final report, the preliminary report shall contain a list of all the work required of other trades in order to allow the balancing work to be completed. The Architect/Engineer will review the preliminary report and inform the Contractor of any additional items or revisions required for the final report. Preliminary reports may be omitted where the Architect/Engineer grants approval.

D. Final Report: Shall be included in the Operation and Maintenance Manual. Submit reports to Contractor for inclusion in Manuals (or, when manuals have been already sent to Engineer, send report to Engineer who will insert report into Manual). Provide number of reports as required to match quantity of O&M Manuals, but in no case less than five.

E. Format: 8-1/2" x 11" size, neat, clean copies, drawings accordion folded. Report shall be typed, shall have a title page, table of contents, and divider sheets with identification tabs between sections. Information shall be placed in a three hole notebook, with the front cover labeled with the name of the Job, Owner, Architect/Engineer, Balancing Contractor, and Report Date.

F. Electronic Copy: Provide copy of reports in *.pdf format; submit final report with

closeout documents per Divisions 00 and 01.

G. General Balancing Information Required:

1. At the beginning of the report, include a summary of problems encountered, deviations from design, remaining problems, recommendations, and comments.
2. List of instruments used in making the measurements and instrument calibration data.
3. Names of personnel performing measurements.
4. Explanation of procedures used in making measurements and balancing each system.
5. List of all correction factors used for all diffusers, grilles, valves, venturi meters, and any other correction factors used.
6. Areas where difficulties were encountered in obtaining design flow rates, or where unstable operating conditions may exist.
7. Note any parts of the system where objectionable drafts or noises may be present and efforts made to eliminate same and why they may still be present.
8. Note where variances from design values occur; explain why.
9. All specified measurements, balancing data, any additional recorded data, and observations.

3.05 COMMISSIONING

A. Selected Division 20 equipment and systems referenced are to be commissioned per Section 01 91 13 – General Commissioning Requirements and Section 20 08 00, Commissioning of Mechanical. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 200593

SECTION 200700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Duct Insulation.

B. Pipe Insulation.

C. Equipment and Specialties Insulation.

D. Acoustical Wrap.

E. Fire Protection Duct Wrap.

1.3 DEFINITIONS

A. R: Thermal resistance of insulation, in units of hr-sf-deg F/Btu.

B. Rainleader Piping: Any piping or conduit that is used to carry rain water, including overflow drain piping, that is located within the building or enclosed by any building construction.

C. Subject to Damage: Items installed exposed less than 8 feet above the walking surface (i.e. floor, platform, roof, grade, etc.) adjacent to the item.

D. Cold Surfaces: Surfaces that will have operating temperatures below the temperature of the surrounding air by at least 5 deg F or more; includes chilled water piping, cooling condensate piping, air conditioning ductwork, outdoor air ductwork, and similar systems. Surfaces shall be considered a cold surface unless specifically indicated otherwise.

1.4 QUALITY ASSURANCE

A. All insulation and materials shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E 84, NFPA 255, and UL 723.

1.5 SUBMITTALS

A. General: All submittals shall comply with Section 200500.

B. Product Data: Provide product data on all insulation materials to be used. Indicate thicknesses to be used.

1.6 GENERAL REQUIREMENTS

A. Code Compliance: Contractor shall insulate all systems with the materials and thicknesses as required by code, but in no case shall the insulation be less than that specified herein. In some cases the specified insulation exceeds code, and shall be provided as specified. Not all systems requiring insulation by code are specified, but shall be provided with insulation where required by code.

B. Insulation at Hangers: Insulation shall be continuous through hangers on all insulated systems (except ductwork). Inserts at hangers are specified in Section 200529 and are considered as part of the hanger and support system. Inserts are required to be installed at the time of pipe installation and are intended to be installed by the Contractor installing the pipe hangers/supports. See Section 200529.

C. All adhesives, sealants, mastics and similar materials shall be low-VOC type, and comply with USGBC LEED requirements.

1.7 REFERENCES

A. ASTM A 653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

B. ASTM B 209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C 411: Standard Test method for Hot-Surface Performance of High Temperature Thermal Insulation.

D. ASTM C 547: Standard Specification for Mineral Fiber Pipe Insulation.

E. ASTM C 1136: Standard Specifications for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

F. ASTM C 1290: Standard Specification For Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

G. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

H. NCIIS: National Commercial & Industrial Insulation Standards, published by Midwest Insulation Contractors Association, 5th Edition.

I. NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.

J. UL 723: Tests for Surface Burning of Building Materials.

K. USGBC LEED: US Green Building Council, LEED Reference Guide for Green Building Design and Construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph Part 2.1, Acceptable Manufacturers.

B. Insulation: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Gilsulate.

C. Accessories: Johns Manville, Armacell, Owens-Corning, Knauf, Rubatex, Aeroflex, Pittsburgh Corning, GLT, Halstead, Duro Dyne, Gustin Bacon, Childers, RPR, Tee Cee, Lewco Specialty Products, JPS, Buckaroos.

D. Acoustical Wrap: Kinetics Noise Control.

E. Fire Protection Duct Wrap: 3M.

2.2 DUCT INSULATION

A. Flexible Glass Fiber:

1. Type: Flexible blanket type, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 1290, Type III. Johns Manville "Microlite" (or approved).
2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforced with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape, minimum 2 inches wide, constructed of jacket material with adhesive to seal all joints.
3. Thermal Conductivity: Shall not exceed 0.27 Btu-in/hr-sq ft-deg F at 75 deg F.
4. Operating Limits: 40 degrees F to 250 deg F.

B. Rigid Glass Fiber:

1. Type: Rigid board type, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 612, Type 1A and 1B. Johns Manville "800 series Spin-Glas".
2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforced with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape constructed of jacket material with adhesive to seal all joints.
3. Thermal Conductivity: Shall not exceed 0.23 Btu-in/hr-sq ft-deg F at 75 deg F.
4. Operating Temperature Limits: 40 deg F to 450 deg F.

C. Corner Angles: 0.016 inch thick aluminum, alloy 3003 or 5005, with factory applied Kraft backing, complying with ASTM B 209.

D. Weather Barrier Mastic: Water based vinyl-acrylic mastic for outdoor weather protection of thermal insulation; fire resistant, UV deterioration resistant. Childers "Vi-cryl" (or approved equal).

E. Glass Fiber Mesh: Open weave glass fiber reinforcing mesh for use with insulation coatings to bridge gaps and add strength to the coating. Minimum 5 strands x 5 strands per square inch. Non-combustible Childers "Chil-Glas" (or approved equal).

F. Metal Jacket:

1. Steel: Minimum 24 gauge galvanized steel complying with ASTM A 653. Provide with longitudinal slip joints and 2-inch laps.
2. Aluminum: Minimum 0.020-inch thick aluminum, alloy 3003 or 5005, complying with ASTM B 209. Provide with longitudinal slip joints and 2-inch laps.
3. Metal Jacket: Minimum 0.032-inch thick gauge galvanized steel complying with ASTM A 653; or fabricated of type 304 stainless steel; smooth surface. Provide with longitudinal slip joints and 2-inch laps. Jacketing at fittings shall be of same material, factory formed to suit fitting and insulation.

G. PVC Jacket: UV resistant polyvinyl chloride covering, minimum 20 mil thick, with joints secured and sealed with "Perma-Weld" Adhesive. Johns Manville "Zeston 300" (or approved).

H. Duct Insulation Types:

1. Exposed-Subject to Damage:

   a. Rectangular Ducts: Rigid glass fiber with metal corner angles.
   b. Round/Oval Ducts: Flexible glass fiber with PVC or metal jacket.

2. Exposed - Not Subject to Damage: Flexible glass fiber.
3. Concealed: Flexible glass fiber.

I. Duct Insulation Thickness:

1. General: Provide insulation densities and thicknesses to achieve the following R values. R values are for the insulation only, in their installed thickness, considering installed duct wrap stretch and in accordance with code.
2. Lining: Where ducts have internal lining, the insulating properties of the lining may be credited toward meeting the required insulation R value; use R-3.65 per inch of installed liner.
3. Supply Air Ductwork:

   a. Inside Building and Within Building's Thermal Envelope: R-3.3 (except where ran exposed in conditioned spaces, no insulation is required).
   b. Inside Building But Not Within Building's Thermal Envelope: R-7.3.
   c. Outside of Building: R-8.

4. Return Air Ductwork:

   a. Inside Building and Within Building's Thermal Envelope: No insulation required; except where duct contains air that may vary by 10 deg F or more from the space the duct passes through, R-3.3 insulation shall be provided.
   b. Inside Building But Not Within Building's Thermal Envelope: R-7.3.
   c. Outside of Building: R-8.

5. Outside Air Ductwork: Shall be insulated same as required for the building envelope; except where allowed by code to be insulated less than the building envelope, shall be R-8; insulation is not required where duct run outside the building.
6. Exhaust, Relief, and Special Ductwork:

    a. Inside Building and Within Building's Thermal Envelope:

        1) Temperature of Air in Duct within 10 Deg F of Temperature of Air in Spaces Duct Passes Through: No insulation required except ductwork from the system's backdraft damper (or motorized damper) to outside the building shall be insulated same as required for the building envelope.
        2) Temperature of Air in Duct more than 10 Deg F Different from temperature of Air in Spaces Duct Passes Through: R-8.3; except ductwork from the system's backdraft damper (or motorized damper) to outside the building shall be insulated same as required for the building envelope (but no less than R-8.3).

    b. Inside Building But Not Within Building's Thermal Envelope: R-8.3.
    c. Outside of Building: Ducts carrying air where condensation can occur (i.e. air from dryers, locker rooms, kitchens, hoods, process loads, etc.) R-8.3; other ducts no insulation is required.

2.3 PIPE INSULATION

A. Glass Fiber:

1. Type: Rigid molded type, constructed of glass fibers bonded by a thermosetting resin, complying with ASTM C 547 Type I. Insulation factory molded to match pipe size applied to. Johns Manville "Micro-Lok" (or approved).
2. Jacket: ASJ type, vapor proof, consisting of a white kraft paper cover reinforced with glass fiber and bonded to aluminum foil, with longitudinal self sealing closure system. Provide with butt strips constructed of jacket material with adhesive to seal all joints. Water vapor permeance shall not exceed 0.02 perms.
3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/ hr-sq ft-deg F at 75 deg F.
4. Operating Temperatures: 0 deg F to 850 deg F.

B. Elastomeric Insulation:

1. Type: Flexible cellular elastomeric insulation, factory formed to match pipe sizes applied to, complying with ASTM C 534, Type 1. Armacell "AP/Armaflex SS" (or approved).
2. Thermal Conductivity: Shall not exceed 0.27 Btu-in/ hr-sq ft-deg F at 75 deg F.
3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.
4. Operating Temperatures: -200 deg F to 220 deg F; shall be able to withstand 250 deg F temperatures for 96 hours per ASTM C 411 without damage or deformation.
5. Weather Protection: Where installed outdoors provide with metal jacketing to protect from UV and weather exposure.

C. Cellular Glass Insulation:

1. Type: Rigid closed-cell glass insulation, factory formed to match pipe size applied to. Pittsburgh Corning “Foamglas” (or approved).
2. Jacket: Field applied heat sealable water-proof jacketing, consisting of 3 layers of a polyer modified bituminous compound separated by glass fiber reinforcement and aluminum foil. Water vapor permeance shall not exceed 0.00 perms. Pittsburgh Corning “Pittwrap” (or approved).
3. Thermal Conductivity: Shall not exceed 0.29 Btu-in/ hr-sq ft-deg F at 75 deg F.
4. Operating Temperatures: -450 deg F to 900 deg F.
5. Compressive Strength: 90 psi.

D. Pipe Fittings: Shall be covered using any one of the following methods of the Contractor's choice:

1. Prefabricated segments of pipe insulation of same materials and thickness as the adjoining pipe insulation, formed to match pipe fitting.
2. Pre-cut fiberglass insulation and pre-molded high impact, gloss white, UV resistant, minimum 20 mil thick, PVC covers suitable for the pipe size and insulation thickness application, PVC cover shall be Johns Manville "Zeston 2000 PVC" (or approved).
3. Insulating plastic cement brought up the full height of the adjacent covering.
4. Fittings shall use PVC covers of the same thickness and color as the PVC jacketing specified for the piping.

E. Metal Jacket: Aluminum roll jacketing, factory formed to match pipe size and insulation application, with smooth surface, manufactured from 3003 or 5005 aluminum alloy, H-14 temper, conforming to ASTM B 209. Shall be minimum 0.020 inches thick, with an integrally bonded interior 1 mil thick heat bonded polyethylene moisture barrier over the entire surface in contact with the insulation. Fitting covers shall be fabricated of same material as pipe runs, factory formed to match fitting.

F. PVC Jacket: Pre-molded 30 mil thick PVC jacket; size and shape to match piping and fittings applied to. Johns Manville “Zeston Series 2000" (or approved). Provide in white color.

G. Pipe Insulation Types:

1. Aboveground-Inside Building:

   a. Steam Systems: Glass fiber.
   b. Cooling Coil Condensate: Glass fiber or elastomeric.
   c. Refrigerant Piping: Elastomeric.
   d. Other Systems: Glass fiber.

2. Aboveground-Outside Building: Same as specified above, with metal jacket.
3. Underground Refrigerant Piping: Cellular glass.
4. Metal and PVC Jacketing: See “Part 3 - Execution”.

H. Pipe Insulation Thickness:

1. General: Provide minimum piping insulation thickness indicated, in inches.

INSULATION THICKNESS (INCHES)

Nominal Pipe Diameter (Inches)					
Fluid Design Operating Range, deg F	≤1	1< to 1-1/2	>1-1/2 to <4	4 to <8	≥8
Above 350	4.5	5.0	5.0	5.0	5.0
251 - 350	3.0	4.0	4.5	4.5	4.5
201 - 250	2.5	2.5	2.5	3.0	3.0
141 - 200	1.5	1.5	2.0	2.0	2.0
61 - 140	1.0	1.0	1.5	1.5	1.5
40 - 60	0.5	0.5	1.0	1.0	1.0
Below 40	0.5	1.0	1.0	1.0	1.5

2. Varying Temperatures: Where a system operates over temperature ranges calling for different insulation thicknesses, the thicker insulation requirements shall be met.
3. Condensate: Cooling system condensate piping (i.e. from a cooling coil) shall be considered to operate at 50 deg F.
4. Rainleader: Rainleader piping shall be considered to operate at 55 deg F.
5. Refrigerant Piping: Refrigerant piping (RG or RS piping) returning from an evaporator (i.e. cooling coil) to a compressor shall be considered to operate at 40 deg F. Refrigerant piping (RL piping) from a condenser to an evaporator does not require insulation (unless noted otherwise).
6. Steam/Condensate Piping: Steam and steam condensate piping shall be considered to operate at the saturated steam temperature corresponding to the system maximum operating pressure, plus 10 degrees.
7. Outdoor Piping: Piping exposed to outside air or, located outside the building/thermal envelope, shall have insulation thickness increased by 0.5 inch from that indicated above. Elastomeric insulation may be used in lieu of fiberglass, provided the insulation is manufacturer approved for temperature of the insulated piping system and application.
8. Cold Water: Cold water piping shall be considered to operate at 56 deg F (unless noted otherwise).

2.4 EQUIPMENT AND SPECIALTIES INSULATION

A. P-traps and HW/CW Lines on ADA Compliant Sinks and Lavatories: Prefabricated insulation specially designed for p-trap application, with white elastomeric insulation, white high gloss pvc cover, and velcro closure. Provide section for insulating HW stop and CW stop and associated piping of same material. McGuire “Pro-Wrap” (or approved).

B. Flexible Glass Fiber:

1. Type: Flexible blanket insulation, constructed of inorganic glass fibers bonded by a thermosetting resin, complying with ASTM C 553, Type III. Johns Manville "812 Spin-Glas" (or approved).
2. Jacket: FSK type, vapor proof, consisting of an aluminum foil cover reinforced with glass fiber mesh, and laminated to kraft. Water vapor permeance shall not exceed 0.05 perms. Provide with joint sealing tape constructed of jacket material with adhesive to seal all joints.
3. Thermal Conductivity: Shall not exceed 0.24 Btu-in/ hr-sq ft-deg F at 75 deg F.
4. Operating Temperature Limits: 40 deg F to 450 deg F.
5. Density: 1.5 lb/cu ft.

C. Semi-Rigid Glass Fiber:

1. Type: Semi-rigid board insulation, constructed of inorganic glass fibers bonded by a thermosetting resin.
2. Jacket: ASJ type, vapor proof, consisting of a white kraft paper cover reinforced with glass fiber and bonded to aluminum foil, with longitudinal self sealing closure system. Provide with butt strips constructed of jacket material with adhesive to seal all joints. Water vapor permeance shall not exceed 0.02 perms.
3. Thermal Conductivity: Shall not exceed 0.29 Btu-in/hr-sq ft-deg F at 75 deg F.
4. Operating Temperature Limits: 0 deg F to 650 deg F.

D. High Temperature Flexible Glass Fiber:

1. Type: Flexible blanket insulation, constructed of "E" type glass filament mechanically needled together. GLT "Tempmat" (or approved).
2. Thermal Conductivity: Shall not exceed 0.40 Btu-in/ hr-sq ft deg F at 300 deg F.
3. Operating Temperature Limits: 40 deg F to 1200 deg F.
4. Thickness: Two wraps of 1-inch thick each wrap.
5. Jacketing: Wire inserted fiberglass cloth closure; minimum 32 Ounce/yard, rated for 100 deg F; with steel lacing and lacing anchors having self locking washers.

E. Elastomeric:

1. Type: Flexible cellular elastomeric insulation, complying with ASTM C 534, Type II.
2. Thermal Conductivity: Shall not exceed 0.30 Btu-in/ hr-sq ft-deg F at 75 deg F.
3. Water Vapor Transmission: Water vapor permeance shall not exceed 0.08 perms.
4. Operating Temperatures: -200 deg F to 220 deg F; shall be able to withstand 250 deg F temperatures for 96 hours per ASTM C 411 with damage or deformation.
5. Weather Protection: Where installed outdoors provide with metal jacketing to protect from UV and weather exposure.

F. Removable Insulation Blankets:

1. Type: Flexible blanket insulation pads, for insulating valves, unions, strainers and similar items. Constructed of exterior fabric enclosure sewn around interior insulation, held in position with a closure system that allows for removal of the blanket. Contractor or factory fabricated.
2. Enclosure:

a. Hot Applications: Glass fiber cloth, 1/8-inch thick, noncombustible, service temperature up to 1200 degrees F. JPS Glass Fabrics "Glastex 2025" (or approved).
b. Cold Application: Silicone impregnated glass fiber cloth; chemical and oil resistant; water proof; flame and abrasion resistant; minimum 20 ounce/square yard weight. Lewco Specialty Products 3000 SA-2 (or approved).

3. Insulation: Thermal insulating wool, 1-inch thick, complying with ASTM C 553. Maximum thermal conductivity 0.22 Btu-in/ hr-sq ft-deg F at 75 degrees F. Provide in layers to give equivalent R value to the adjacent insulated piping. Owens Corning "Fiberglas Brand TIW, Type II".
4. Closure System: Velcro, zipper or steel lacing. Steel lacing anchors shall have spindles and self-locking washers, fabricated of minimum 14 gauge stainless steel, with stainless steel wire ties. AGM Industries "Series NLA" (or approved). Closure shall be configured to allow for complete coverage and closure of the insulation around the object being insulated. Closure for cold surfaces (surfaces that operate below ambient air temperature) shall provide a sealed vapor barrier so that no surfaces are exposed to ambient air and so that no condensation can occur; overlap enclosure ends (or any vapor barrier penetrations, as caused by suing steel lacing anchors) with an added vapor barrier cover, minimum 2-inches past the vapor barrier penetration; with Velcro (or equivalent) closure.

G. Corner Angles: 0.016 inch thick aluminum, alloy 3003 or 5005, with factory applied Kraft backing, complying with ASTM B 209.

H. Metal Jacket:

1. Steel: Minimum 24 gauge galvanized steel complying with ASTM A 653. Provide with longitudinal slip joints and 2-inch laps.
2. Aluminum: Minimum 0.020-inch thick aluminum, alloy 3003 or 5005, complying with ASTM B 209. Provide with longitudinal slip joints and 2-inch laps.

I. Equipment and Specialties Insulation Types and Thickness:

1. Unless a specific type of insulation is specified or noted, any of the insulation materials specified in this specification section may be used provided such application is in conformance with NCIIS.
2. Insulation Thickness: Insulation thickness shall be the same as that specified for the piping or ductwork connected to the item, or as specified for the system the item is installed in (unless noted otherwise). Insulation thickness shall in no case be less than 1 inch thick.
3. Valves:

a. 2 Inches and Smaller: Insulate with same material as piping system.
b. 2-1/2 Inches and Larger: Removable blanket insulation.

4. All equipment and specialties where access is required shall have removable insulation blankets; other removable insulation materials per NCIIS may be used

where pre-approved by the Engineer. Items requiring such removable insulation include, but are not limited to, the following:

a. Strainers.
b. Balancing valves.
c. Pressure/temperature/flow measuring devices.

5. Roof Drains: 1 inch thick glass fiber.

2.5 ACCESSORIES

A. Adhesive, Caulks, Mastics, and Coatings: As recommended by insulation material manufacturer and suited for the application.

B. Bands: 1/2-inch wide, of stainless steel, galvanized steel, or aluminum construction, to match with materials used with.

C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length shall be as required for insulation thickness used with. Welded pin holding capacity 100 lb, for direct pull perpendicular to the attached surface. Style and type to suit application.

D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness used with. Adhesive as recommended by the anchor pin manufacturer as appropriate for surface temperatures and materials used with, and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface. Style and type to suit application.

2.6 ACOUSTICAL WRAP

A. Type: Composite material having an outer foil faced sound barrier wrap with an internal sound decoupling insulation. Kinetics Noise Control KNM-100ALQ (or equal).

B. Construction: Outer sound barrier material shall be flexible 1.10 inch think, 1 lb/sf (minimum) barium sulphate loaded limp vinyl sheet, bonded to an outside layer of aluminum foil. Interior sound decoupling insulation shall be 1 inch think fiber glass batting quilted to a non woven porous scrim-coated glass cloth in a 4 inch diamond stitch pattern. Material shall be suitable for temperatures from 40 to 200 deg F.

C. Acoustic Rating: STC (sound transmission coefficient) 28 (or better).

D. Vibration Damping Material: Kinetics Noise Control KDD or KDC-E-162.

2.7 FIRE PROTECTION DUCT WRAP

A. Type: Encapsulated fireproof blanket for use as a zero-clearance to combustible construction and as an alternative to rated shaft enclosure for kitchen grease exhaust ducts and fire rated air ducts.

B. Materials: Inorganic fiber blanket encapsulated with aluminum foil scrim. Melting point shall be no less than 3200 def F. Material shall be at least 1-1/2 inches thick, and be installed in layers and thickness necessary to provide the required fir resistance rating. Material shall be flexible, easily contoured, to allow wrapping around ductwork.

C. Listing: Shall be listed and labeled for use as a field applied grease duct enclosure.

PART 3 - EXECUTION

3.1 GENERAL

A. Pre-Insulation Review: No covering materials shall be applied until systems to be covered have had all tests satisfactorily completed, have had all required inspections, and have been satisfactorily reviewed by the Architect-Engineer. All systems shall be examined by the Contractor to confirm cleanliness and other conditions are appropriate to allow for insulation installation.

B. Insulation Work Review: No insulated items shall be concealed in the building structure or buried until the insulation work has been satisfactorily reviewed by the Architect-Engineer, and has had all required inspections.

C. Standards: Materials shall be installed in accordance with manufacturer's written instructions, NCIIS, and shall comply with materials and methods specified herein. The more stringent requirements govern.

D. Joints/Seams: Joints shall be staggered on multi layer insulation. Locate seams and joints in least visible location.

E. Insulation Protection: Insulation shall be kept clean and dry and shall be protected from dirt, damage, and moisture. Insulation that becomes dirty, damaged, or wet and cannot be restored to like new condition will be rejected, and shall immediately be removed from the jobsite.

F. Insulation Interruptions: Insulation shall be neatly finished at all supports, protrusions and interruptions. Provide adhesive and tape seal to maintain vapor barrier integrity.

G. Equipment and Floor Protection: Cover existing equipment and finished floors to protect such items from insulation fiber and dust. Keep all such existing areas in a "broom clean" condition at the end of each day. Take precautions in these areas to prevent glass fiber and insulation dust from entering ventilation systems or areas adjacent to the work.

H. Glass Fiber Insulation - General:

1. Finish all insulation ends with joint sealing tape or vapor barrier mastic, no raw edges allowed.
2. Joints: Tightly butt adjacent insulation sections together without any voids. Provide overlap of jacket material over all joints.

I. Items To Be Insulated: Provide insulation on all ductwork, all piping, all items installed in these duct and piping systems, all air and liquid energy conveying systems and

components, all air and liquid energy storage, all equipment, and all energy consuming devices, except where such insulation has been specifically excluded.

J. Items Excluded From Being Insulated:

1. Sanitary sewer drain lines (except traps at handicap accessible fixtures).
2. Stops and risers at plumbing fixtures (except at handicap accessible fixtures).
3. Factory insulated water heaters (except for base on electric water heaters).
4. Factory insulated tanks.
5. Electric motors.
6. Fans.
7. Factory insulated or factory lined HVAC, AHU, and AC units.
8. Pumps handling hot water.
9. Condensate receivers.
10. Relief Valves and associated drain piping.
11. Hose bibbs (except where used as drains on hot water systems).
12. Water meter.
13. Underground cold water piping and associated underground items.

3.2 DUCT INSULATION INSTALLATION

A. Types and Thickness: Insulate all ducts with insulation type and thickness (to provide the required R value) as specified in “Part 2 - Products”.

B. General: Insulation shall be firmly butted at all joints. All longitudinal seams for flexible insulation shall overlap a minimum of 2 inches. All joints and seams shall be finished with appropriate joint sealing tape. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.

C. Attachment: For rectangular ducts over 24 inches wide, duct insulation shall be additionally secured to the bottom of the ductwork with mechanical fasteners on 18 inch centers to reduce sagging. Washers shall be applied without compressing the insulation. Protruding ends or fasteners shall be cut off flush after washers are installed. All seams, joints, penetrations, and damage to the facing shall be sealed with joint sealing tape or vapor retardant mastic or appropriate joint sealing tape.

3.3 PIPE INSULATION INSTALLATION

A. Types and Thickness: Insulate all piping with insulation type and thickness as specified in “Part 2 - Products”. All piping shall be insulated except where specifically excluded.

B. General: All ends shall be firmly butted together and secured with joint sealing tape. All jacket laps and joint sealing tape shall be secured with outward clinch staples at 4 inch spacing, or by use of a suitable adhesive. Installation shall provide a continuous sealed vapor barrier over all surfaces; seal all jacket penetrations with vapor barrier mastic or vapor barrier jacket tape.

C. Elastomeric Pipe Insulation: Install with seams and joints sealed with rubberized contact adhesive. Insulation with pre-applied adhesive is not permitted. A brush coating of adhesive shall be applied to both butt ends to be joined and to both split surfaces to be

sealed. Adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Provide added tape wrap around insulation to ensure seam and joint closure. Insulation that can be pulled apart one hour (or more) after adhesive installation shall be replaced. Provide metal jacketing over outdoor exposed insulation.

D. Pipe Hangers: Provide insulation tight up to pre-insulated pipe supports at pipe hangers, seal all joints with joint sealing tape. Pre-insulated pipe supports are specified in Section 200529.

E. Pipe Sleeves: Run insulation continuous full size through sleeve. Coordinate work with fire seals and confirm fire seal system is approved for use with insulated pipes; see Section 200530.

F. Metal Jacketing:

1. Applications: Provide metal jacket over piping insulation for the following:

a. Exposed rain leaders in occupied areas; from finished floor and up 8 feet.
b. Outdoor exposed piping.

2. Outdoor Installation: Where installed on outdoor piping locate seams on bottom side of horizontal piping. Seal all jacket seams to provide a completely weatherproof enclosure; water tight.

G. Roof Drains: The interior side of roof drains shall be insulated with minimum 1-inch thick and 1 pound density fiberglass insulation with vapor barrier.

H. PVC Jacketing: Provide PVC jacketing on all piping within 10 feet of floor level in the main mechanical room and on all piping exposed in Central Services and the Kitchen.

3.4 EQUIPMENT AND SPECIALTIES INSTALLATION

A. Types and Thickness: All equipment and items installed in insulated duct and piping systems shall be insulated except where specifically noted not to be; reference paragraph 3.1. Insulation type and thickness shall be as specified in “Part 2 - Products”.

B. General: Apply insulation as close as possible to equipment by grooving, scoring, and beveling as necessary. As required, secure insulation to equipment with studs, pins, clips, adhesive, wires or bands. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. Comply with NCIIS.

C. Removable: All equipment and specialties where access is required for maintenance, repair, service, or cleaning shall have insulation installed so that it can be easily removed and reinstalled without being damaged and without requiring new insulation. Removable insulation shall completely cover the item being insulated with an overlap over adjacent insulation to cover all joints. Insulation on cold surfaces shall provide a sealed vapor barrier so that no surfaces are exposed to ambient air and so that no condensation can occur; overlap enclosure ends minimum 2-inches.

D. ADA Compliant Lavatories and Sinks: Insulate P-trap and HW/CW supplies below lavatory and sink where exposed.

E. Nameplates: Do not insulate over nameplates or ASME stamps; bevel and seal insulation around.

F. Jacketing: Provide all equipment insulation with vapor retardant jackets.

3.5 ACOUSTIC WRAP

A. General: Install in accordance with manufacturers written instructions and NCIIS. Overlap all interior sound insulation joints with a minimum 2 inch overlap of the exterior sound barrier. Acoustical insulation shall not be compressed. Where installed over equipment or items requiring access, provide acoustic wrap in sections and in a manner that facilitates future removal and re-installation.

B. Light Gauge Duct: Where the ductwork to which the wrap is to be applied is less than 20 gauge, apply vibration damping material on outside of duct before applying acoustic wrap.

C. Insulated Items: Where installed on ducts or items that require thermal insulation, install thermal insulation over acoustic wrap.

D. Locations: Provide acoustic wrap on the first 10 feet of supply (or discharge) duct off all air handling units, fans, and at locations noted on plans.

3.6 FIRE PROTECTION DUCT WRAP

A. General: Install in accordance with manufacturers written instructions and UL listing to provide duct protection equivalent to a 2 hour rated shift enclosure.

B. Locations: Provide fire protection duct wrap at locations noted on plans and on all ducts serving Type I hoods or appliances.

END OF SECTION 200700

SECTION 20 08 00 – COMMISSIONING OF MECHANICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following section specifies general commissioning activities for this project:

01 91 13 GENERAL COMMISSIONING REQUIREMENTS

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Testing, Adjusting and Balancing

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Commissioning General Requirements, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified 01 91 13, Commissioning General Requirements, Part 3 – Execution.

SCHEDULE A – Start-up Plan, Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed.

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Testing, Adjusting, and Balancing						
TAB Agenda						
TAB Meeting Minutes						
Preliminary TAB Report						
Contractor Checklist		CxA Provided				

SAMPLE

Contractor Checklist

Unit Type:	**Testing, Adjusting and Balancing**	Unit No:	**N/A**

Check	RC	CxA	Note
Start-Up			
Balancing agenda provided to engineer. Provide copy to CxA for review.			
Pre-balance conference complete. Attach meeting minutes.			
HVAC equipment operation verified.			
Relief damper operation has been checked to assure dampers open and close as needed.			
Construction filters removed, clean filters installed, damper position and operation checked prior to balancing.			
Readiness			
Bathrooms are negative relative to other areas.			
Room pressures are positive while allowing for door closure in economizer mode.			
Overall building pressure checked with outside air at 100% to assure adequate relief.			
Noise and vibration has been checked and adjusted as necessary.			
Final damper and speed controller permanently marked for final balancing positions.			
All systems balanced to specified design criteria except as approved by mechanical engineer.			
Preliminary report has been provided on approved forms with data specified.			
List of control minimum OA damper positions in report and provided to controls contractor.			
All defects/ deficiencies have been noted to CxA/ engineer during testing, included in report.			
All TAB procedures are complete and ready for the system balance demonstration. The TAB contractor will demonstrate proper balance by measuring and verifying a percentage of the systems as selected and witnessed by the Commissioning Authority.			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor shall be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that shall be conducted on this project. This table shall be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table shall be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A **System Description**	B **Responsible Contractor**	C **Proposed Test Forms Received**	D **OK**	E **Testing Complete**	F **OK**	G **Notes**
Balancing Air and Water						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Balancing Air and Water Systems
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	10%	N/A

Functional Tests:

1) Perform measurements to demonstrate air balance meets design tolerances.
2) Perform measurements to demonstrate building pressurization in various modes of operation.
3) Perform measurements to demonstrate room pressurization in various modes of operation.

The testing and air balancing contractor shall demonstrate a properly balanced system by measuring and verifying the specified percentage of the previously balanced systems as selected and witnessed by the Commissioning Authority. The TAB contractor shall also demonstrate the proper pressure relationship of the spaces to each other and the outside.

In the event that the testing and balance verification values are off by more than 10% of original testing values, the balancing contractor shall readjust the systems to the satisfaction of the owner and design team.

All balancing set points, including, but not limited to, outside air minimum positions, air flow measuring stations, duct static set points, and differential pressure information shall be communicated to the controls contractor for implementation into the DDC system and recorded in the final balance report.

END OF SECTION 200800

SECTION 21 08 00 – COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following sections specify commissioning activities for this project:

01 91 13 – General Commissioning Requirements

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Fire Suppression Systems

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified Section 01 91 13, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Water –Based Fire-Suppression Systems						
Pressure Testing		n/a				
Cleaning and Flushing		n/a				
Test Certificate		n/a				
Contractor Checklist		CxA Provided				

SAMPLE
Fire Protection – Wet Pipe Sprinkler System
Contractor Checklist

Location: **Area/Room Served:**
Manufacturer: **Model:**

Check	RC	CxA	Note
Equipment			
Area is cleaned and clear of construction debris.			
Equipment is clean and has no visible physical damage.			
Manufacturer's required maintenance clearance provided.			
Equipment and systems are labeled per project documents.			
Spare heads and wrench box installed per project documents			
Piping			
Piping installed with slope to drain.			
Unions installed on all equipment requiring disconnects for servicing.			
Dielectric unions installed on all dissimilar materials.			
Pressure gages installed at all specified points, gage range as specified.			
Mechanical supporting devices installed at specified locations and spacing.			
Valves provided and installed per specification in regards to connection style and size.			
Valves installed for area and group isolation, maintenance isolation and service disconnects.			
Control Devices			
Tamper devices are installed and connected to fire alarm system			
Fire flow devices are installed and connected to fire alarm system			
Start-Up			
Piping is complete, flushed, and pressure tested.			
Double detector check valve is complete, tested and tagged.			
Start-up documentation submitted to CxA.			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor will be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that will be conducted on this project. This table will be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table will be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A	B	C	D	E	F	G
	Responsible Contractor	**Proposed Test Forms Received**	**OK**	**Testing Complete**	**OK**	**Notes**
Fire-Suppression Systems						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Fire Suppression Systems
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
A.1	Contractor	Contractor	N/A	100%

Functional Tests:

1) Wet System
   a) System trip
   b) Water gong or alarm
   c) Alarm reporting
   d) Tamper reporting

2) Dry System
   a) System trip
   b) Water gong or alarm
   c) Alarm reporting
   d) Tamper reporting
   e) System drain and reset
   f) Compressor operation
   g) Low air alarm

PART 4 - Sample Documents

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that will be required from the contractor. These forms and procedures will be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that will be required to be executed by the contractor.

Not Used. Fire Suppression Contractor to provide test report format.

END OF SECTION 210800

SECTION 211200 - FIRE SUPPRESSION SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS AND SPECIAL CONDITIONS:

A. Bidding requirements, general conditions, general requirements, appendices, and addendums apply to the work under this section as depicted in Project Specification Manual.

1.2 GENERAL DESCRIPTION:

A. Provide all materials, labor, equipment, and approvals required for new and complete Automatic Sprinkler (A.S.) system in accordance with the Local Fire Marshal, National Fire Protection Association (NFPA), International Fire Code (I.F.C.), and any other Authorities having jurisdiction. It shall further include furnishing and installing all miscellaneous items required for the proper operation of the A.S. system, whether specifically called for or not. Install and deliver all systems complete, in perfect working order, and in full accordance with the intent and meaning of the specifications and/or drawings.

B. This Contract shall begin at point of connection to the underground riser supply line. Coordinate required work with Utility Contractor. This point of connection may occur at 5’-0” beyond building or at flange connection at base of riser. Contractor to confirm point of connection with civil engineer and site utility contractor.

1.3 INTENT OF SPECIFICATIONS:

A. It is intended that the work performed pursuant to these specifications shall be complete in every respect; resulting in a system installed entirely in accordance with all current applicable codes, standards, manufacturer's recommendations and U.L. listings and FM approvals. All work in general consists of, but is not necessarily limited to, these specifications and latest accepted code approved design and installation standards.

B. It is further intended that upon completion of work, the Owner shall be provided with the following:

1. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, trouble-shooting, and expanding the system at a future date.
2. Complete documentation of system testing.
3. Written certification that the system has been tested and inspected, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations, U.L. listings, F.M. approvals, etc. and is in proper working order.
4. It is intended that the Contractor be responsible for work with other trades.

1.4 RELATED WORK PROVIDED BY OTHER SECTIONS:

A. The following related work shall be performed under other sections:

1. Painting of sprinkler piping and valves, including the placement and removal of bags or other protection devices on sprinklers to prevent paint from touching any portion of the sprinkler.
2. Alarm system shall be provided by Electrical and/or Alarm Contractor(s).
3. Concrete filled pipe guard posts for protection of riser(s), backflow assembly, etc. shall be provided where equipment or materials are subject to vehicular traffic.
4. Concrete splash blocks at main drain, inspector's test outlets and auxiliary drain outlets, if necessary.

1.5 WORK TO BE PERFORMED:

A. Complete automatic sprinkler system protection throughout the building in accordance with these specifications and drawings as well as all NFPA 13, I.F.C, and local AHJ requirements.

B. Be fully informed regarding all regulations and limitations of the spaces available for installation of the automatic sprinkler system. Later claims for labor, work, material, and equipment required for any difficulties encountered that could have clearly been foreseen will not be recognized, and all such difficulties shall be properly handled by this Contractor at no additional cost to the Owner.

C. Fire hose rack(s), with hose valves, fire hose nozzles and automatic drip, etc., if required by the local AHJ.

D. Valve diagrams, pipe markers, metal signs and riser design placards.

E. Operating and maintenance manual.

F. New 2-way siamese-type fire department connection (F.D.C.) for A.S. system with National Standard Threads (P.H.T.) as required by local fire department. Provide with check valve. Automatic drip is required if F.D.C. is not remotely located.

G. Install A.S. system waterflow indicating equipment and valve supervisory devices on all devices and valves. Wiring shall be by Electrical and/or Alarm Contractor(s).

H. Inspector's test and auxiliary drain locations necessary to test and completely drain each A.S. sprinkler system. Remote test stations may be required. Contractor to provide as required by the local AHJ.

I. Shop drawings, fabrication drawings (if Contractor chooses to submit), equipment submittals, record drawings and other submittals required herein.

J. Complete testing of new A.S. system in accordance with local AHJ.

K. Guarantee all new equipment and systems for a one year period after date of substantial completion as determined by Architect, Owner or His/Her Agent and Contractor.

L. Repair all damage resulting from this work. Including all materials, fittings and fixtures. All pipe openings shall be closed so as to prevent obstructions and damage.

M. Sleeves and related fire rated seals and waterproofing shall be strictly commensurate with the penetration.

N. Inserts, hangers, clamps, sway bracing, etc., as required to hang and support piping in accordance with NFPA and/or this specification.

O. Accuracy of pre-fabricated pipe, location of sprinklers and deflectors (per NFPA and inspections), field fit of piping, piping elevations, riser nipple lengths and dimensioning.

P. Obtain fire flow testing data as required by the AHJ if the flow testing data provided on the FP contract drawings is not deemed acceptable to the AHJ.

1.6 CODES, STANDARDS, ORDINANCES AND PERMITS:

A. All work shall conform to the requirements of the applicable portions of the National Fire Protection Association (NFPA) Standards and Recommended Practices (including Appendices) listed herein:

1. NFPA-13, 2013 Edition, "Standard for the Installation of Sprinkler Systems".
2. NFPA-291, 2013 Edition, “Recommended Practice for Fire Flow Testing and Marking of Hydrants”.
3. NFPA-24, 2013 Edition, "Private Fire Service Mains and their Appurtenances".
4. NFPA-25, 2013 Edition, "Inspection Testing and Maintenance of Water-Based Fire Protection Systems".

B. All work, materials, and equipment shall conform to all Local, State and Federal Codes as well as all other Authorities having jurisdiction. If alternate editions of aforementioned standards, or additional standards are required then they shall be applied as accepted by Local and State codes.

C. If there is a conflict between the FP bid drawings, this specification, referenced standards, codes, or Authorities having jurisdiction; then it shall be the Contractor's responsibility to bring the conflict to the attention of the Owner or his/her Agent immediately for resolution prior to commencement of any additional work. This conflict shall be resolved at no additional cost to the Owner.

D. The Contractor shall be responsible for filing all documents, paying all fees and securing all permits, inspections and approvals necessary for conducting this work.

1.7 QUALITY ASSURANCE:

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with all precautions required and has complied with all the requirements of the Authorities having jurisdiction. Installer shall be licensed with the State and Local

Authorities having jurisdiction. Submit evidence of such qualifications to the Owner or his/her Agent with submission of bid.

1.8 DEFINITIONS:

A. Contractor: The Fire Protection Contractor and any of his/her sub-contractors, vendors, suppliers, or fabricators.

B. Provide: Furnish and install.

C. Furnish: Purchase and deliver to other trades or Owner for installation.

D. Install: Install materials, equipment or assemblies furnished by other trades or Owner.

E. Concealed: Where used in connection with installation of piping and accessories, shall mean that hidden from sight as in chases, furred spaces, pipe shafts, or above suspended ceilings. "Exposed" shall mean "not concealed" as defined above.

F. Owner: Owner or his/her designated Representative.

G. Fire Protection Consultant:

1. NRG Fire Consulting.
2. Contact: Sean Pisoni, CET
3. Phone: 206.789.0165

1.9 SUBMITTALS:

A. The Owner or his/her Agent, Architect and Fire Protection Consultant shall review all submittals for conformance to these specifications.

B. Contractor may submit for review and approval any proposed substitution of materials or method of installation, from that specified, with material submittals.

1. Proposed substitutions of method of installation shall be designed by a NICET Level III or IV Certified Engineering Technician or Technologist.
2. Before proposed substitutions of method of installation are submitted to Architect for approval, they shall have the following specified stamps of approval:

a. Local Fire Marshal.

C. If submittals or proposed substitutions, upon review are found not to conform to the requirements of these specifications, the Contractor shall be required to resubmit with modification. Not approved items shall be resubmitted. The Contractor shall be responsible for the Owner's expenses for subsequent revisions of rejected submittals necessitated by the Contractor's failure to make the requested modifications. Such extra fees shall be deducted from payments by the Owner to the Contractor.

1.10 RESERVED.

1.11 SHOP/FABRICATION DRAWINGS:

A. Within 30 days after award of contract, the Contractor shall submit six (6) sets of manufacturer's data sheets, catalog cut sheets and data on devices for all necessary approvals prior to fabrication of materials.

B. Contractor shall submit complete packages. Partial submittals will be returned without further explanation.

C. No extension of the contract time will be granted for the Contractor's failure to allow sufficient time for review and processing, or for shop drawings which have been returned due to improper submission.

D. The Contractor will not be authorized to start any portion of the work until the shop/fabrication drawings, catalog cuts and other required submittals for that portion are received, reviewed, and approved by all required parties.

1.12 OPERATION AND MAINTENANCE MANUAL:

A. The Contractor shall provide the Owner with a loose-leaf manual containing;

1. A detailed description of the system.
2. A detailed description of routine maintenance required or recommended or as would be provided under a maintenance schedule and detailed maintenance instructions for each type of device installed.
3. Manufacturer's data sheets and installation manuals/instructions for all equipment installed.
4. A list of recommended spare parts.
5. Service Directory.
6. 11-inch by 17-inch reduced copies of the "record" drawings.

B. Within 30 days of the completion of the work, two (2) copies of the manual shall be delivered to the Owner.

1.13 RECORD DRAWINGS:

A. The Contractor shall maintain on the site an accurate record of all changes made to the system layout from that shown on the approved drawings.

B. Upon completion of the work, before final approval, one (1) set of reproducible mylar "record" drawings and two (2) additional sets of blue line "record" drawings, and electronic PDF files shall be delivered to the Owner. Contractor shall coordinate this with Architect.

C. At least one set of approved drawings with all required stamps of approval shall be maintained on-site and made available to all Authorities having jurisdiction on demand during construction phase of work.

1.14 VALVE DIAGRAMS:

A. At the completion of the work, provide a small scale of the building(s) indicating the location of all control valves, low point drain(s), and inspectors test(s). The plan shall be neatly drawn and color coded to indicate the portion of the building protected by each system, framed under glass (not plastic), and permanently mounted on the wall adjacent to each sprinkler riser.

1.15 CHANGES:

A. Make no changes in installation from layout as shown on the approved drawings unless change is specifically approved by the Engineer. This does not include minor revisions for the purpose of coordination, or to clear ducts or obstructions.

B. Any changes made other than stated above are at the Contractor’s own expense and responsibility.

1.16 LEAK DAMAGE:

A. The Contractor shall be responsible during the installation and testing period of the sprinkler system for any damage to the work by others, to the building, its contents, etc. caused by leaks in any equipment, by unplugged or disconnected pipes, fittings, etc., or by overflow, and shall pay for the necessary replacement or repairs to work of others, damaged by such leaks.

1.17 FREIGHT AND HAULING:

A. Deliver materials to the job site, unload, and store in location determined by the Owner's Representative and General Contractor.

1.18 BASE BID:

A. The base bid shall be lump-sum or in accordance with Division I of specifications.

B. The Contractor shall indicate the number of sprinklers included in the base bid, including the number of sprinklers allowed for obstructions and ductwork.

1.19 CLEANUP:

A. Maintain the premises free from accumulation of waste material or rubbish caused by this work.

B. At the completion of the work, remove all surplus materials, grease, oil, etc. from piping, tools, etc., and leave premises in a neat, clean workmanlike manner.

1.20 SAFETY:

A. All work shall be performed in compliance with the Occupational Safety and Health Act of 1970 and Construction Safety Acts Standards (or current).

1.21 GUARANTEE PERIOD:

A. The Contractor shall guarantee in writing (triplicate) all materials and workmanship for a period of one year beginning with the date of substantial completion. The Contractor shall be responsible during the design, installation, testing and guarantee period for any damage caused by him/her (or his/her Subcontractors) or by defects in his/her (or his/her Subcontractor's) work, materials, or equipment.

1.22 EMERGENCY SERVICE:

A. During the warranty period, the Contractor shall provide emergency repair service for the entire automatic sprinkler system. This service shall be provided on a 24-hour per day, 7 day per week basis. Coordinate details with Owner's Representative.

1.23 SPARE PARTS AND SPECIAL TOOLS:

A. Contractor shall install code approved metal sprinkler cabinet(s) containing sprinklers of all types, finishes, and temperature ratings used and two (2) sets of sprinkler wrenches compatible with each type of sprinkler provided. The cabinets shall be installed at the locations approved by the Owner and NFPA requirements. Sprinkler and cabinet quantities shall be per NFPA-13.

B. The Contractor shall supply the Owner with two (2) complete sets of special tools and equipment necessary to perform routine maintenance on the sprinkler systems.

1.24 FINAL APPROVAL AND ACCEPTANCE:

A. Final approval and acceptance of the work will not be given by the Owner until:

1. The completed sprinkler system(s) has/have been inspected, tested and approved by the Owner, Architect, and all other Authorities having jurisdiction.
2. Required submittals, system operation and maintenance manuals, "record" drawings, spare parts, and special tools have been provided to, reviewed, and accepted by the Owner.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA:

A. Provide automatic sprinkler systems throughout in all areas as required by NFPA, Authorities having jurisdiction, these specifications and approved construction documents. Design densities to be within strict compliance with the requirements of NFPA 13 and based on the occupancy use, storage configuration and commodities, etc.

B. Freeze protection will be required for any piping/heads that are not within the enclosed and conditioned, or refrigerated box spaces of the building. Freeze protection to be provided via dry barrel heads when possible. Alternately, a dry-riser may be necessary or anti-freeze type systems upon approval by the architect and AHJ.

2.2 SPRINKLER SYSTEM COMPONENTS - GENERAL:

A. All equipment and system components furnished and installed shall be new and unused, of first quality, and be listed by Underwriters Laboratories Inc. and approved by Factory Mutual for their intended use. All such equipment and system components shall be installed within the limitations of the respective U.L. listings or FM approvals. Equipment and material used shall generally be from a consistent manufacturer.

2.3 PIPING:

A. Manufacturers:

1. Wheatland Tube
2. Bull Moose Tube Company

B. All piping 4-in. and larger shall be schedule-10. All piping 3-in. and smaller shall be schedule-40. All piping shall have a CRR value of 1.0 or greater. Couplings, fittings, and any other wet components must have a CRR value of 1.0 or greater.

C. Sprinkler system piping or tubing shall meet the requirements of NFPA 13, be U.L. listed and F.M. approved. Contractor shall base his/her bid on the use of any one or a combination of the following: In addition, all pipe shall have a minimum Corrosion Resistance Ratio (CRR) of 1.00 or greater, as per U.L. listings.

D. All piping shall be new and approved for 175 psi working pressure conforming to ASTM A135 and A795 guidelines and FM approved for fire sprinkler system installation. All piping and fittings shall be North American manufactured only. No substitutions will be acceptable per the owner. All piping shall be black steel, prepared for painting. If foreign piping is observed to be installed, the unapproved pipe shall be removed at the contractor’s expense, and legal action may be warranted by the owner.

1. ASTM A53 piping is listed for use in sizes 2” through 6” only for fire sprinkler piping applications and should only be used if ASTM A795 listed piping is unavailable. The contractor should exhaust all means in acquiring the desired ASTM A795. Documentation must be obtained from the manufacturer and included in the Material Data Submittal stating that the ASTM A53 piping is UL Listed and FM approved for fire sprinkler applications.

E. Underground pipe and fittings (to riser flange or 5’-0” beyond building): Class 150 centrifugal cast iron enameling, or cement lined mechanical joint, "Tyton" joint, conforming to USAS A-21.6 (AWWA Specification C-106); or "Permastran" conforming to ASTM D 2992 and ASTM D 2996. Class 50 ductile iron pipe. Block underground piping, fittings and thrust blocks per NFPA - 24.

F. Flanges and flanged fittings shall be 175 psi cast iron with standard ring gaskets.

G. Pipe and fittings shall be listed by Underwriters Laboratories, Inc. and approved by Factory Mutual for use in fire protection systems and designed to withstand a working pressure of not less than 175 psi.

H. All pipe and fittings exposed to the weather, downstream of all inspector's test valves, between exterior wall and check valve on FDC, or located in a corrosive atmosphere shall be hot-dipped zinc coated (galvanized) and/or painted if approved by the owner.

I. Flexible couplings shall be U.L. and F.M. approved.

J. Pipe penetrations through masonry and fire rated construction shall be sleeved and sealed with fire rated seals commensurate with the building construction.

K. Pipe penetrations through floors and exterior walls shall be approved waterproof seals.

L. When system piping pierces a foundation wall below grade or is located under the foundation wall, clearance shall be provided to prevent breakage of piping due to building settlement. Do not locate pipe joints within or under a foundation wall and a 1-3 inch clearance shall be provided around piping by use of sleeve for piping piercing a foundation wall. Sleeve properly and fill clear space with approved waterproof packing.

M. Use of foreign-made piping, fittings, or materials shall not be permitted.

N. Use of copper or CPVC piping and fittings in accordance with NFPA-13 and pipe listing is permissible where prior-approved only.

2.4 AUTOMATIC SPRINKLERS:

A. Sprinklers shall be of the listed automatic, glass bulb type, and shall be distributed throughout the building per code and approved construction documents.

B. Sprinklers required due to ceiling projections/obstructions and ductwork are not considered additional sprinklers. Contractor shall be responsible for identifying these locations.

C. Install ordinary, intermediate and high temperature sprinklers of proper degree rating wherever necessary to meet requirements of NFPA, and Authorities having jurisdiction. K-factor and head selection to be based on the specific requirements of NFPA 13 and based off the occupancy use, storage configurations, operating temperatures, etc.

D. Provide corrosion resistant sprinklers with factory applied coating where sprinkler is to be located in a corrosive and wet atmosphere (canopies, wash-down areas, etc.). Confirm exact locations and requirements with the architect or owner.

E. Sprinkler and escutcheon finishes shall be suitable for area or ceiling finish provided. Verify finish of all sprinklers and escutcheons with Owner or his/her Agent prior to ordering.

2.5 INSPECTOR'S TEST CONNECTIONS:

A. Provide test connection at most remote portion of each A.S. system, with 1" pipe and valve. Test connection piping shall be connected to sprinkler branch line at least 1-1/4" in diameter and shall discharge outside building through smooth bore brass outlet. Outlet orifice shall be equal to smallest sprinkler orifice utilized in the sprinkler system.

2.6 HANGERS:

A. Use eye-rod and beam-clamp and rings and hang from top chord of joists. Do not hang from bottom chord of joist or bridging.

B. Trapeze all mains if required. Verify all hanger types with Structural Drawings and Structural Engineer prior to commencement of any work.

C. Provide sway bracing. Install in accordance with NFPA-13. Pipe to be generally supported by clamps and rods and secured to overhead construction.

2.7 AUTOMATIC AIR RELEASE SYSTEMS:

A. Provide automatic air release systems at a high point per each fire sprinkler zone as per the requirements of NFPA 13, Section A.8.16.4.2.2. Collection points at high points shall be connected so that the number of units necessary is minimized. Contractor shall verify system high points and provide as many air release devices as necessary to provide effective air-venting of sprinkler lines. Air-vents shall be piped to exterior or sanitary sewer drain where allowable.

PART 3 - EXECUTION

3.1 STARTING AND COMPLETION DATES:

A. The schedule for installation of the sprinkler systems will be established at the pre-bid meeting. Coordinate schedule closely with General Contractor, Owner, and Architect.

3.2 INSPECTION:

A. The Contractor shall daily examine all areas in which the work will be performed. The Contractor shall immediately report unsatisfactory working conditions to the Owner or his/her Agent for resolution. The Contractor shall not proceed with the work until all unsatisfactory working conditions have been corrected.

B. Owner, Architect, and all Authorities having jurisdiction shall be allowed to conduct inspections and tests as they choose. Approved sprinkler plans must be available on the project site during installation and inspection of the work.

3.3 INSTALLATION GENERAL:

A. All holes made by the Contractor in any wall, ceiling or floor shall be patched by the Contractor, restoring the wall, ceiling or floor to its original condition, fire resistance and integrity.

B. Removal and repair of all finished surfaces shall be coordinated with the Architect and subject to his/her approval.

C. Location of all equipment, controls, piping, valves and drain shall be subject to Architect/Owner approval.

D. Standard metal signs shall be provided in accordance with NFPA-13.

E. All sprinklers and equipment shall be installed in accordance with manufacturer's instructions. All special tools recommended by the manufacturer shall be used.

3.4 INSTALLATION PIPING AND SPRINKLERS:

A. Where sprinkler piping is installed in finished areas, the Contractor shall install all new piping so that it is concealed above finished ceilings, provide a minimum separation of 12" between the ceiling height and the bottom of the sprinkler pipe. Pipe installed in unfinished areas may be exposed.

B. All exposed pipe which passes through a wall, ceiling, or floor shall be provided with escutcheon plates. Any fire wall penetrations should be avoided when possible. If fire wall penetrations are required, piping shall be sealed with approved UL listed fire rated caulking and in compliance with AHJ and manufacturer requirements.

C. All piping shall be installed so as not to obstruct any portion of a window, doorway, stairway or passageway, and shall not interfere with the operation or accessibility of any mechanical, plumbing or electrical equipment. Run piping horizontally and at right angles to walls and ceilings or along slope of ceilings.

D. Center sprinklers in both horizontal directions with respect to ceiling components, such as ceiling grid (in center tile of 2’-0” direction and at quarterpoints of 4’-0” direction), light fixtures, HVAC diffusers, speakers and detectors as required.

E. All sprinkler piping, drain and test piping, etc. installed through exterior walls shall be galvanized and have a 4'-0" minimum length to first valve located inside insulated building envelope.

F. All sprinkler piping must be substantially supported from building structure and only approved type hangers shall be used. Sprinkler lines under ducts shall not be supported from ductwork, but shall be supported from building structure with trapeze hangers where necessary, in accordance with NFPA-13. Tapping or drilling of structural elements is not permitted unless approved by the structural engineer. Use beam clamps or hang from top chord of joist. Do not hang from bottom chord of joist.

G. Pendent sprinklers shall be in alignment with, and parallel to ceiling fixtures, walls, etc.

H. Install sprinkler piping in exposed areas as high as possible using necessary fittings and auxiliary drains to maintain maximum clear head room, and to keep space aesthetically acceptable to Architect/Owner.

I. Sprinklers shall be installed per the requirements of NFPA 13 with regard to ducts, obstructions, steel beams and joists, partitions, and ceiling projections. Provide additional sprinklers as required. Contractor to recognize and account for the additional sprinkler heads in their bid knowing that some obstructions will occur and to be field verified during construction.

J. Provide sprinkler protection below any ducts, banks of piping, etc., greater than 48" in width in all sprinklered areas.

K. Contractor shall provide complete sprinkler protection before combustible contents are moved into the building.

L. All sprinkler piping and fittings shall be so installed such that system may be drained. System shall primarily be designed to drain through main drain at riser(s).

M. Minimum and maximum deflector distances shall be per NFPA requirements. A minimum of 18–inches from deflector to top of storage shall be provided.

N. A minimum distance between sprinklers, as required by NFPA and the individual sprinkler U.L. listing or F.M. approval, shall be provided to avoid cold soldering of sprinklers.

O. Provide fire protection during construction as required by local Authorities having jurisdiction.

3.5 SYSTEM DRAINS:

A. Provide 2" main drain valves at system control valves and extend piping to outside building. Provide a 4'-0" minimum length of main drain piping from exterior wall penetration to angle valve.

B. Provide all auxiliary drains where necessary, extend and terminate at safe location.

C. Provide 1/2" minimum pressure relief valve and drains on each riser supplying a gridded system.

D. Pipe all drains to a location where water drained will not damage stock, equipment, vehicles, planted areas, etc., injure personnel, or patrons, or cause an unsightly wet area in front of any entrances.

E. Plugs used for auxiliary drains shall be brass.

F. Pressure relief and main drains shall not be interconnected.

3.6 CEILING AND WALL PLATES:

A. Install chrome wall plates wherever exposed sprinkler piping passes throughout ceiling and walls.

3.7 SLEEVES:

A. Set sleeves securely in place for all pipes passing through floor and masonry wall openings.

B. Space between sleeve and pipe shall be filled with packing commensurate with construction. Provide chrome wall plates at each side of wall.

C. Sleeves and seals through floors and exterior wall shall be watertight.

D. All sleeves shall meet requirements of all Authorities having jurisdiction and Owner.

3.8 INSPECTOR'S TEST:

A. Provide inspector's test connections as specified in NFPA-13. Discharge orifice shall have same size orifice as smallest orifice of any sprinklers installed.

B. Provide 1" site glass where inspector's test discharge cannot be readily observed while operating valve.

C. Pipe all inspector's test connection discharges to atmosphere at location where water drain will not damage stock, equipment, vehicles, planted areas, etc., injure personnel, or patrons, or cause an unsightly wet area in front of any entrance.

D. All pipe and fittings downstream of inspector's test valve shall be galvanized.

3.9 SPRINKLER GUARDS AND WATER SHIELDS:

A. Provide guards for sprinklers within 7 feet of finish floor or wherever sprinklers may be subject to mechanical damage.

B. Sprinklers located under open gratings, stairways, or in racks, shall be provided with shields and wire sprinkler guards.

3.10 WELDING AND FLAME CUTTING:

A. No welding or flame cutting by the Contractor shall be permitted on the premises.

B. Shop welding (off-site) shall meet all NFPA-13 and related requirements. Retrieve all discs from piping prior to site delivery.

3.11 FINAL INSPECTION AND TESTS:

A. Overhead sprinkler piping: Tested for a period of two hours at a hydrostatic pressure of 200 lbs. and all piping, valves, sprinklers, etc., shall be watertight.

B. Underground piping: Tested (by Utility Contractor) for a period of two hours at a hydrostatic pressure of 200 lbs. in accordance with NFPA Standards. Leakage shall not exceed quantities indicated. Coordinate with Utility Contractor to ensure proper testing and test schedule.

C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion(s) of the system.

D. All underground piping shall be thoroughly flushed (by Utility Contractor) in accordance with the requirements of NFPA Standards, prior to connection to overhead piping system. The flush test must be witnessed by all Authorities having jurisdiction. A test shall be

made before the trench in which pipe is laid is backfilled. Coordinate with Utility Contractor to ensure proper testing and test schedule.

E. The Contractor shall make arrangements with all Authorities have jurisdiction for final inspection and witnessing of the final acceptance tests.

F. If, when the Owner's consultant or any other Authorities having jurisdiction visit the job site for this purpose after being advised by the Contractor that the work is completed and ready for test, the work has not been completed, or the final acceptance tests are unsatisfactory, the Contractor shall be responsible for Consultant's extra time and expenses for reinspection and witnessing the retesting of the work. Such extra fees shall be deducted from payments by the Owner to the Contractor.

G. Contractor shall provide at least (5) working days notice to Architect and Owner via General Contractor for all tests and field observations.

H. Flushing of all piping shall be conducted with water flowing at a minimum velocity of 10 feet per second.

I. Selected Division 21 equipment and systems referenced are to be commissioned per Section 01 91 13 – General Commissioning Requirements and Section 21 08 00, Commissioning of Fire Suppression Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

SECTION 22 08 00 – COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following sections specify commissioning activities for this project:

01 91 13 – General Commissioning Requirements

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Domestic Hot Water & Circulator

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified Section 01 91 13, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Domestic Hot Water Heater						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Domestic Hot Water Pumps						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

SAMPLE
Domestic Hot Water Heaters – Gas
Contractor Checklist

Water Heater WH-1
Location: **Area/Room Served:**
Manufacturer: **Model:**

Check	RC	CxA	Note
Equipment			
Area is cleaned and clear of construction debris.			
Unit is clean and has no visible physical damage.			
Equipment labels are installed per project documents.			
Unit is accessible for service.			
Mounting is appropriate with vibration isolation as specified.			
Piping			
Piping insulated per project documents.			
Piping, valves and insulation are complete.			
Temperature and pressure indicators as specified.			
Control Devices			
Control wires and devices are complete.			
Control wire and devices are labeled.			
Electrical			
Supply power is installed and disconnect is accessible.			
Disconnect is labeled.			
Nameplate Minimum Circuit Amps.			
Nameplate Maximum Overcurrent Protection Device Amps.			
Installed overload.			
Overloads and/or fusing is appropriate.			
Operating controls and safeties are installed.			
Convenience outlet within 50’ of equipment.			
Start-Up			
Manufacturer’s installation and start-up procedures complete.			
Start-up documentation submitted to CxA.			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor will be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that will be conducted on this project. This table will be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table will be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A	B	C	D	E	F	G
	Responsible Contractor	**Proposed Test Forms Received**	**OK**	**Testing Complete**	**OK**	**Notes**
Hot Water Heaters/Pumps						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Domestic Water Systems
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
C.1	CxA	Contractor	N/A	100%

Functional Tests:

1) Distribution
   a) Pump Operation

2) Water Heater
   a) Temperature control
   b) Relief

3) Mixing Valves
   a) Temperature control

PART 4 – SAMPLE FUNCTIONAL TEST DOCUMENTS

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that will be required from the contractor. These forms and procedures will be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that will be required to be executed by the contractor.

Domestic Hot Water – BAS Controlled with BAS Aquastat and Pump Proof

Occupied Mode

1. Place the system in the occupied mode.
2. Create a demand for hot water by increasing the temperature set point if necessary or using hot water.
3. If circulation pump is equipped with an aqua-stat, verify aqua-stat set point is high enough to cause pump to circulate.
4. Return set point to original value at end of test.

Hot water tank set point at start of test ____

	1	2
Hot water circulation pump is enabled.		
Combustion air damper is open.		
Water heater burner is enabled and firing.		
Hot water tank set point returned to original setting.		

Unoccupied Mode:

1. With the system in the occupied mode, create a demand for hot water at the hot water tank (or continue from previous test).
2. Adjust the return water temperature set point to well below the return water temperature.
3. Place the system in the unoccupied mode.
4. Verify pump is disabled, combustion damper is closed and hot water is disabled.
5. Return hot water tank to original set point as needed.

	1	2
Hot water circulation pump is disabled		
Combustion air damper is closed		
Water heater burner is disabled		
Hot water tank set point returned to original setting		

BAS Aqua-Stat Operation:

1. Verify system is in the occupied mode.
2. Start test with return water temperature above set point, adjust set point as needed.
3. Record initial parameters.
4. Turn the aqua-stat set point up higher than the return water temperature.
5. Verify pump is commanded on, status is on and pump is observed on.
6. Turn off the pump at the disconnect and verify pump failure alarm is generated.
7. Turn power to pump back on and verify alarm clears.
8. Turn the aqua-stat set point down to lower than the return water temperature.
9. Verify pump is commanded off, status is off and pump is observed off.
10. Return set point to original setting.

	1	2
PRE-TEST:		
System in occupied mode		
Return water temperature.		
Return water temperature set point		
Pump command/status is OFF		
TEST:		
Return water set point changed to		
Pump command/status are ON		
Pump failure alarm received		
Pump failure alarm cleared		
Pump observed ON		
Return water set point changed to		
Pump command/status are OFF		

☐ Tests are complete and performance is acceptable.

Commissioning Authority: Date:

Comments:

END OF SECTION 220800

SECTION 220900 - INSTRUMENTATION AND CONTROL FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Thermowells.

B. Plumbing Control Tubing.

C. Plumbing Control Valve Installation.

1.3 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Submit a complete list of equipment to be furnished, including product information for each item on the material list.

1.4 GENERAL REQUIREMENTS

A. General: The control system is specified in Division 25. The Division 22 contractor is required to coordinate the work of this Division with the control system work to allow installation of items required for the plumbing control system, and to install the control items indicated.

1.5 REFERENCES

A. ASTM B88: Standard Specification for Seamless Copper Water Tube.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Thermowells: Trerice, Ashcroft, IPS, RTD, Texas Thermowell, Thermometrics.

2.2 THERMOWELLS

A. Series 300 stainless steel or brass construction, with 2 inch lagging neck and extension type well. Diameter and insertion length to suit application.

2.3 TUBING

A. Soft Copper tubing, per ASTM B 88.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install items in accordance with manufacturer's instructions and control system requirements. Coordinate all work requirements with Division 25.

B. Thermowells: Provide all plumbing system thermowells required by the control system. Install thermowells in accessible locations and to allow for proper control system operation.

C. Tubing: Provide all control tubing necessary to properly connect all plumbing control devices (e.g. differential pressure sensors, gauges, etc.).

END OF SECTION 220900

SECTION 221100 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Domestic Water Piping.

B. Non-Potable Water Piping.

C. Valves.

D. Water Hammer Arrestors.

E. Trap Primers.

F. Backflow Preventers.

G. Water Meters.

H. Domestic Water Expansion Tanks.

I. Water Service Connections.

J. Testing and Inspection.

K. Flushing and Disinfection.

1.3 DEFINITIONS

A. "Lead-Free" means not containing more than 0.2% lead in solder and flux; and not more than a weighted average of 0.25% lead in wetted surfaces of pipes, pipe and plumbing fittings and fixtures.

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data: Submit manufacturer’s product information on all items to be used.

C. System Tests and Inspections: Submit documentation showing systems have satisfactorily passed all pressure tests and code inspections.

D. Cleaning and Disinfection: Submit documentation regarding completion of flushing, disinfection, bacteriological tests, and Health Department’s acceptance of tests and

system.

1.5 GENERAL REQUIREMENTS

A. ANSI/NSF Compliance: All items in contact with potable water shall be lead free in accordance with ANSI/NSF 61. Plastic piping system components shall comply with ANSI/NSF 14. Only lead-free solder shall be used.

B. Valves: Shall be dezincification resistant, and shall not contain more than 15% zinc in their chemical composition.

1.6 REFERENCES

A. ASME B16.3: Malleable Iron Threaded Fittings.

B. ASME B16.15: Cast Bronze Threaded Fittings: Classes 125 and 250.

C. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

E. ASME B16.24: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500.

F. ASTM A53: Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

G. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM A312: Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

I. ASTM A403: Wrought Austenitic Stainless Steel Piping Fittings.

J. ASTM A530: General Requirements for Specialized Carbon and Alloy Steel Pipe.

K. ASTM A774: As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

L. ASTM A 778: Welded, Un-annealed Austenitic Stainless Steel Tubular Products.

M. ASTM B16.18: Seamless Copper Water Tube.

N. ASTM B32: Solder Metal.

O. ASTM D1784: Chlorinated Poly (Vinyl Chloride) CPVC Compounds.

P. ASTM F437: Threaded Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fittings, Schedule 80.

Q. ASTM F439: Socket-Type Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fitting.

R. ASTM F441: Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe.

S. ASTM F493: Solvent Cement for Chlorinated Poly (Vinyl Chloride) CPVC Pipe and Fittings.

T. ASTM F876: Standard Specification for Cross-linked Polyethylene (PEX) Tubing.

U. ASTM F877: Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.

V. ASTM F1960: Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

W. AWS A5.8: Filler Metals for Brazing and Braze Welding.

X. AWWA B300: Hypochlorites.

Y. AWWA B301: Liquid Chlorine.

Z. AWWA M20: Water Chlorination and Chlorination Practices and Principles, 2nd edition.

AA. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials.

BB. ANSI/NSF Standard 61 Drinking Water System Components – Health Effects.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, 2.1, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. Valves: Conbraco/Apollo, Nibco, Stockham, Walworth, Milwaukee, Kitz, Red-White, Watts, Hammond.

D. Pressure Reducing Valves: Conbraco/Apollo, Watts, Cla-Val, Bell & Gossett, Zurn/Wilkins.

E. Thermostatic Mixing Valves: MCC Powers, Leonard, Symmons.

F. Backflow Preventers: Conbraco/Apollo, Febco, Watts, Ames, Zurn/Wilkins.

G. Balancing Valves: Bell & Gossett, Taco, Armstrong, Red-White.

H. Additional manufacturers are as listed for each individual item.

2.2 PIPE AND FITTINGS - MATERIALS

A. Copper Pipe and Fittings:

1. Pipe: Seamless copper water tube, hard temper (unless noted otherwise), type K

or L as indicated, per ASTM B88.

2. Fittings:

   a. Solder-Joint: Wrought copper and bronze fittings per ASME B 16.22 and cast copper alloy fittings per ASME B16.18, cast bronze threaded fittings per ASME B16.15.
   b. Flanged: Cast bronze fittings per ASME B16.24.
   c. Solder Material: 95/5 tin-antimony solder per ASTM B32 or "Silvabrite 100" (95.5 tin/4 copper/0.5 silver) solder; lead free.
   d. Brazing Material: AWS A5.8, BCuP-5.

B. Galvanized Steel Pipe and Fittings:

1. Pipe: Seamless hot-dip galvanized steel pipe, per ASTM A 53, Type E, Grade B. Schedule 40 unless indicated otherwise.
2. Fittings: Galvanized, malleable-iron, threaded, per ASME B16.3.

C. Stainless Steel Pipe and Fittings:

1. Pipe: Seamless or welded stainless steel per ASTM A778 or A312, type 304L or 316L, tolerances per ASTM A 530. Schedule 40 unless indicated otherwise.
2. Fittings:

   a. Threaded: Constructed of same material as piping, per ASTM A774 or A403, suitable for 150 psi swp.
   b. Welded: Constructed of same material as piping, weld fittings, per ASTM A774 or A403, suitable for 150 psi swp.
   c. Flanged: Constructed of same material as piping, 150 pound class.

D. PEX Pipe and Fittings:

1. Pipe: Cross-linked polyethylene (PEX), manufactured per ASTM F876 and F877. Color shall be blue for cold water systems, and red for hot water and hot water recirculation systems. Piping used underground shall be continuous with no joints or fittings and be rated for underground use by the piping manufacturer.
2. Fittings: Pipe manufacturers standard methods, manufactured in accordance with recognized standards.
3. Ratings: Minimum pressure rating of 100 psi at 180 deg F, and 80 psi at 200 deg F in accordance with the Plastic Pipe Institute standards.
4. Firestop Penetrations: Piping system manufacturer (or fire seal manufacturers) shall have listed methods (acceptable to the AHJ) for piping penetrations through rated building elements (for the type of elements penetrated on this project).
5. Ultraviolet (UV) Light Exposure: Piping shall be meet or exceed a 60 day exposure to UV light in accordance with ASTM F876. Piping which may be exposed to UV light after installation shall have an insulation jacket with UV protection (or equivalent method) approved by the piping manufacturer to protect the pipe from UV exposure.
6. Chlorine Resistance: Piping and system components used shall be rated for use with 100% chlorine at 140 deg F in accordance with ASTM F876 per PEX 5006.
7. Intermediate Support (Contractor Option): Galvanized steel channel, sized and shaped to match PEX pipe and to allow for increased spacing between supports.

Minimum 23 gauge. Subject to AHJ approval. Manufactured by pipe manufacturer support is used with.

E. Rigid PVC Pipe and Fittings: Polyvinyl chloride pipe, Schedule 80 per ASTM D 1785. Solvent cement socket type fittings per ASTM D 2466. Solvent cement shall comply with ASTM D 2564.

F. Low Extractable Pipe and Fittings: Virgin Polyvinyl Chloride (PVC) compound with a cell classification of 12343 per ASTM D 1784, produced to Schedule 80 dimensions per ASTM D 1785 (pipe) and ASTM D 2467 (fittings) and with a Type II pressure rating. Spears "Low Extractable Piping" or approved equal. Solvent cement shall be specifically manufactured for use with low extractable pipe and fittings. (Addendum 3)

2.3 PIPE AND FITTINGS - APPLICATIONS

A. Domestic Water Piping - Above Ground: Type L or K copper with flanged or soldered joints or stainless steel; except where run exposed in finished areas shall be stainless steel, or be chrome plated copper, or be copper piping with a chrome plated sleeve.

B. Domestic Water Piping - Below Ground: Type K copper tubing with silver brazed joints; except that piping within the building footprint serving individual fixtures may be type L (soft or hard temper) copper.

C. Non-Potable Water Piping: Type L copper with solder or flanged joints.

D. Reverse Osmossis Water Piping: ~~Rigid Schedule 80 PVC pipe and fittings.~~ *Low extractable pipe and fittings.* (Addendum 3)

E. Trap Primer Piping: Type L or K "soft" or "hard" (bending temper) copper, with compression fittings or soldered joints or PEX.

2.4 VALVES

A. Ball Valves:

1. 2 Inches and Smaller: 600 psi non-shock cold working pressure, 100 psi at 300 deg F, bronze body, full port, 2 piece construction, anti-blowout stem, reinforced PTFE seats, stainless steel or chrome plated brass or silicon bronze ball, lever handle, solder or threaded connections. Provide with extended lever handle where valve is installed in systems with insulation thickness greater than 0.5 inch. Nibco S-585-80-LF, T-585-80-LF (or approved). *Except that valves in RO systems shall be low extractable type with all parts compatible with reverse osmosis and pure water applications.* (Addendum 3)
2. 2-1/2 Inches and Larger:

   a. Cold Water Applications - Copper Alloy: 400 psi non-shock cold working pressure copper alloy body, full port, anti-blowout stem, PTFE seats, stainless steel or chrome plated brass ball, plated steel lever handle. Nibco T-FP-600A-LF (or approved).
   b. Stainless: Class 150 stainless steel body, split-body full bore design, anti-blowout stem, carbon filled TFE seats, stainless steel ball, stainless steel

trim, plated steel lever handle. Nibco F-515-S6-F-66-FS (or approved).

c. Cast Iron: Class 125 psi-swp, cast iron body, split-body full port, anti-blowout stem, PTFE seats, stainless steel ball and stem. Conbraco/Apollo 6P Series (or approved).

B. Gate Valves:

1. 2 Inches and Smaller: Not allowed.
2. 2-1/2 Inches and Larger: 125 psi-swp iron body gate, bronze mounted, bolted bonnet, OS&Y, flanged. Nibco F-617-O (or approved).

C. Check Valves:

1. 2 Inches and Smaller:

a. Horizontal: 125 psi-swp bronze body horizontal swing check valve, regarding type, y-pattern, renewable seat and disc, solder or threaded connection. Nibco S-413-LF or T-413-LF (or approved).
b. Vertical: 125 psi-swp bronze body vertical inline check valve, stainless steel or bronze disk holder, Buna-N disk, stainless steel spring actuated, solder or threaded connection. Nibco S-480-LF or T-480-LF (or approved).

2. 2-1/2 Inches and Larger:

a. Horizontal: 125 psi-swp iron body vertical inline “silent” check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910 (or approved).
b. Vertical: 125 psi-swp iron body vertical inline “silent” check valve, wafer or flanged style, renewable seat and disk, stainless spring actuated, bronze disk. Nibco W-910, F-910 (or approved).

D. Balancing Valves: Calibrated balance valve, ball or globe type, bronze body, with brass readout valves with integral EPT insert and check valve to minimize fluid loss during balancing. Valve shall have calibrated nameplate and memory stop. Rated for 200 psig working pressure at 250 degrees F. Valve shall be same size as pipe installed in. Bell & Gossett "Circuit Setter" (or approved).

E. Drain Valves: Bronze ball valve, minimum 125 psi-swp, anti-blowout stem, stainless steel or chrome plated brass ball, reinforced TFE seat, solder or threaded inlet connection, male 3/4 inch hose thread outlet connection, with brass cap and chain. Nibco S-585-70-HC, T-585-70-HC (or approved).

F. Pressure Reducing Valves:

1. 2 Inches and Smaller: Bronze body construction, renewable nickel alloy or stainless steel seat, lead free, with integral strainer and union inlet connections. Adjustable range 25 to 75 lbs, suitable for inlet pressures up to 300 psi. Watts Series U5 (or approved).
2. 2-1/2 Inches and Larger: Ductile iron or bronze body, bronze trim, 150 pound pressure class, with flanged or screwed ends. Valve shall be globe type, with

adjustment range from 15 to 75 psi. Valve shall be a hydraulically operated, diaphragm-actuated pressure reducing valve. Diaphragm shall consist of a nylon fabric bonded with a synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line. The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve, designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice, flow strainer, and speed control. Cla-Val Series 90-01 (or approved).

G. Pressure Relief Valves: ASME rated pressure relief valve, bronze body, stainless steel spring, set for pressure indicated or as required to protect system from over pressure. Valve shall have minimum 400,000 BTU/HR relief capability (at set pressure) and no smaller than 3/4-inch connection sizes.

2.5 ACCESSORIES

A. Water Hammer Arrestors: All metal, factory pre-charged with inert gas, sealed internal bellows; 125 psi working pressure. All wetted parts shall be type 300 stainless steel, brass or copper. PDI (Plumbing and Drainage Institute) sizes as indicated. Where not sized, provide sizes in accordance with PDI standards. Zurn "Shoktrol", Wade "Shokstop", or J.R. Smith "Hydrotrol".

B. Trap Primer Valve: Activated by drop-in water pressure. Constructed of corrosion resistant brass with integral backflow preventor, vacuum breaker ports, distribution manifold to suit number of drains served, adjustable to line pressure for water delivery. Precision Plumbing Products Model P-1 and P-2 (or approved).

C. Filters: Replaceable cartridge type water filter. 5 micron filtration with maximum 0.4 psi pressure drop at 5 gpm. Watts "Flow-Max" filter and FH5000 series housing (or approved). (Addendum 3)

2.6 BACKFLOW PREVENTERS

A. Reduced Pressure Type:

1. General: Washington State approved, with air gap drain fitting and resilient seated full flow shutoff valves and test cocks. Same size as connecting pipe. Configuration to suit application. Conforming to AWWA C511.
2. 2 Inches and Smaller: Bronze body, stainless steel springs, bronze ball valves, 175 psi working pressure, threaded end connections.
3. 2-1/2 Inches and Larger: Ductile iron body, internal and external epoxy coating per AWWA C550, OS & Y gate isolation valves, bronze trim, stainless steel springs, 175 psig working pressure, Class 125 flanged end connections (grooved connections allowed where mechanically coupled piping systems are allowed).
4. Discharge: Discharge from intermediate relief valve assembly shall not exceed 190 gpm for 2-inch and smaller backflow preventers, and not exceed 560 gpm for larger backflow preventers (rated at 75 psig inlet pressure).

2.7 WATER METERS

A. Water Main Water Meter: Magnetic drive turbine meter, with bronze outer cases, high impact resistant plastic register lid and clamp band, plastic inlet hub, rotor and strainer. Bottom plate shall be of bronze or enamel coated cast iron, with thick rubber liner for protection, and attached to meter housing with stainless steel bolts and washers. Register shall be magnetically driven and hermetically sealed between a glass dome and metal housing. Register shall read in U.S. gallons, minimum 10,000,000 gallon capacity, and with 10 gallons/sweep hand revolution. The clamp band shall allow for positioning the register in the most convenient reading position. Meter shall be suitable for up to 175 psig and 32 to 130 degree F temperatures. Mueller-Hersey Model MVR (or approved). Provide with Pulser interface unit for meter interface with DDC system. Shall convert high frequency pulse signal from meter's frequency transmitter to a user selectable choice of three signal durations.

2.8 DOMESTIC WATER EXPANSION TANK

A. Type: Diaphragm thermal expansion absorber. Amtrol "ST" Series (or approved).

B. Construction: Welded steel construction, with polypropylene liner, butyl/EPDM diaphragm, stainless steel air charging valve, 175 psig working pressure, configuration/connections to suit installation, NSF 61 approved, and ASME certified.

C. Capacity: As indicated on plans; where not indicated provide 12.0 gallon tank volume (minimum).

PART 3 - EXECUTION

3.1 GENERAL

A. Workmanship: Installation of all items shall comply with code, best professional practices, manufacturers written installation instructions, and to allow for proper functioning of items being connected to.

B. Complete System: Provide all piping as indicated and as required to allow supply connections to each fixture and equipment item requiring water supply. Provide offsets as required to accommodate building construction and access requirements per Section 200500. For multistory buildings include costs to offset vertical piping at each floor level since structural member locations will not be the same on each floor.

C. Coordination: Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. Equipment By Others: Provide piping connections to equipment furnished by others in accordance with Section 200500.

E. Hot Water Adjustment: Adjust the hot water circulation system for uniform circulation throughout the system; provide balancing of system where hot water circulation system has multiple branches with balancing valves (see balancing specification Section). Install, set, and adjust and all system components for proper operation.

3.2 PIPE AND FITTINGS

A. Concealed: All piping in finished areas shall be installed concealed unless specifically noted otherwise. Provide escutcheons where piping is allowed to be exposed and pipe passes through building elements (i.e. walls, floors, ceilings, etc.).

B. Non-Obstructing: Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur.

C. Drawing Review: Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Insulation: Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

E. Drainage: Slope all piping to low points to allow the system to be drained. Provide added drain valves where system cannot be drained through fixtures.

F. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

G. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary.

H. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

I. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

J. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

K. Unions: Install unions in pipe connections to valves, coils, and any other equipment where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.

L. Insulating Unions: Install dielectric insulating connectors between all connections of copper piping and steel piping of steel equipment. Where flanged connections occur use insulating type flanges.

M. PEX Tubing:

1. Minimum Bend Radius (cold bending): No less than six times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for

tubing with a bend radius less than stated.

2. Install tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
3. Do not install PEX tubing within 6 inches of gas appliance vents or within 12 inches of any recessed light fixtures.
4. Do not solder within 18 inches of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
5. Do not expose PEX tubing to direct sunlight for more than 30 days.
6. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
7. Use grommets or sleeves at the penetration for PEX tubing passing through metal studs.
8. Protect PEX tubing with sleeves where abrasion may occur.
9. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.
10. Use tubing manufacturer supplied bend supports where bends are less than six times the outside tubing diameter.
11. Minimum horizontal supports are installed not less than 32 inches between hangers in accordance with plumbing codes and manufacturer's installation instructions.
12. Pressurize tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi above normal working pressure of the system.
13. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32 deg F.
14. At locations where the piping may be exposed to UV light, piping system shall be completely covered and protected to prevent such exposure.

N. Plastic Pipe with Solvent Joints:

1. Solvent Joints: The outside of the pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.
2. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.3 VALVES

A. Type: Ball type only; except that valves 2-1/2 inches and larger may be the ball or gate type and valves indicated to be a specific type shall be the type as noted.

B. General: Provide isolation valves as shown on the drawings. In addition to those shown, provide added valves to allow for the isolation of each group of fixtures, all water heaters, and all individual equipment items (e.g. dishwashers, heat exchangers, etc.).

C. Installation: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or

horizontal direction. Provide access doors for valves not otherwise accessible.

D. Pressure Reducing Valves: Provide with by-pass line, isolation valves, unions (on valves with threaded connections), and pressure gauges. Set initial pressure and adjust as required so that all fixtures/devices served have sufficient water pressure.

E. Drain Valves: Provide drain valves at the base of all risers (except not required where risers can be drained through plumbing fixtures or equipment drains). Provide drain valves at piping low points where the piping cannot be drained through fixtures, hose bibs, or equipment drains.

F. Balancing Valves: Provide balancing valves in hot water circulation piping where indicated and where required to allow for equal distribution of hot water circulation flows.

3.4 ACCESSORIES

A. Water Hammer Arrestors: Install per manufacturer's instructions, just upstream of last fixture on branch line. Provide water hammer arrestors on branch water lines serving fixtures with flush valves, washer machines, solenoid valves, and similar quick-acting valves. Water hammer arrestors are typically not shown on the plans, but shall be provided per this paragraph. Provide ball isolation valve in piping to arrestor. Where access cannot be provided at water line location, the water hammer arrestor piping may be extended vertically and the water hammer arrestor located above ceiling outside of plumbing chase.

B. Trap Primers: Provide trap primers to all vented floor drains, floor receptors, and where required by the code. Install with an isolation valve in the branch line to the trap primer valve.

C. Access Doors: Provide access doors to all valves, water hammer arrestors, trap primers, backflow preventers, and any other piping accessories which would otherwise be inaccessible. See Section 200519 for access door specifications.

D. Backflow Preventers:

1. General: Provide backflow preventers as indicated in the Contract Documents and as required by code. Backflow preventers with threaded connections shall be installed with unions for ease of removal. Install to be accessible for testing and service. Pipe air gap drains to nearest floor drain or point of drainage.
2. Inspection: Arrange and pay for inspection of backflow preventers as required by the local AHJ and obtain installation acceptance from the AHJ.
3. Certification: Following inspection pay arrange and pay for testing of backflow preventers by certified individuals in accordance with applicable portions of the Washington Administrative Code, other applicable regulations as set forth by the Washington State Department of Social and Health Services, and as required by the AHJ.

E. Water Meters: Provide water meters of type, and in locations, as shown on the drawings. Coordinate with Division 25 contractor for DDC monitoring.

F. Domestic Water Expansion Tanks: Provide isolation valve for servicing expansion tank. All isolation valves between expansion tank and water heater shall be labeled, "Expansion Tank Service Valve: Must Be Open When System Is Operating".

3.5 WATER SERVICE CONNECTIONS

A. Provide connection to water main outside the building as shown on the drawings.

B. Provide sleeve in floor for entrance of service main into building, seal watertight; anchor service main firmly to building. See Section 200530 for sleeves and seals.

3.6 TESTING AND INSPECTION

A. All piping shall be tested, inspected, and approved by the local authority having jurisdiction prior to being concealed or covered.

B. Testing shall be witnessed by the plumbing inspector and the Architect/Engineer (at his option). Notify Architect/Engineer minimum 72 hours prior to date of testing, and mutually agreed upon times arranged.

C. Piping shall be hydrostatically tested for a period of 2 hours (or as required by local authority having jurisdiction), during which time no drop in pressure or leakage shall occur.

D. Test pressure shall be not less than 150 percent of the maximum to which the pipe will ordinarily be subjected; but in no case less than 75 psig.

E. Any leaks or defective piping disclosed by testing and inspection shall be repaired with new materials and the system re-tested.

F. Provide documentation to the Engineer indicating that the system has been completely pressure tested, and all portions inspected and accepted by the local authority having jurisdiction.

3.7 FLUSHING AND DISINFECTION

A. System Flushing: After tests are completed, all water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. System valves and fixture faucets shall be opened and re-closed to completely flush system. After flushing and cleaning, systems shall be prepared for disinfection service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building during this process shall be repaired by the Contractor.

B. Disinfection:

1. Upon completion of the job and prior to final acceptance, the plumbing system shall be disinfected with Chlorine solution. Review procedures and disinfection with the authority having jurisdiction to insure that all work complies with code

requirements. Verify any deviations from specified procedures with the Architect/Engineer prior to proceeding. The chlorinating material shall be either liquid chlorine conforming to AWWA B301 or hypochlorite conforming to AWWA B300 (or as otherwise required by the authority having jurisdiction). Water chlorination procedure shall be in accordance with AWWA M20 (or procedure acceptable to AHJ and to the Architect/Engineer). The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system in an approved manner. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria.

2. The retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine at the extreme end of the system at the end of the retention period. All valves in the system being sterilized shall be opened and closed several times during the contact period. The system shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period all valves and faucets shall be opened and closed several times.

C. Bacteriological Tests: The Contractor shall employ an approved agency to take test samples at several points of the system (i.e. end of each wing, each floor of building, etc.) in properly sterilized containers and arrange with the Health Department (or a test agency acceptable to the Health Department) having jurisdiction to test the samples. Test for coliform and other items as required by the AHJ. Should the samples not test satisfactory, the system shall be re-flushed and disinfected again until satisfactory samples are obtained.

D. Submittal: Submit documentation stating that flushing and disinfection has been completed, copies of the bacteriological test results, and certification from the Health Department having jurisdiction stating that system has been found acceptable.

END OF SECTION 221100

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Domestic Circulators.

1.3 SUBMITTALS

A. General: All submittals shall comply with Section 200500.

B. Product Data: Provide product information and performance data for all pumps.

C. Performance Data: Submit performance data, including pump curves, showing pump performance as head vs. GPM, BHP and NPSH vs. GPM, with system operating point clearly marked. (NPSH vs. GPM not required for pumps 1 HP and less.)

1.4 QUALITY CONTROL

A. Manufacturer: Manufacturer shall be IS0-9001 approved.

B. General: Provide quality assurance checks specified in Section 200500 prior to ordering materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Domestic Circulators and Wet Rotor Circulators: Bell & Gossett, Armstrong, Grundfos, Taco.

2.2 GENERAL

A. Balancing: All rotating parts shall have been statically and dynamically balanced at the factory.

B. Alignment: Pump and motors shall be factory aligned, and have alignment checked and reset once installed in place.

C. RPM: Pumps and motors shall operate at 1750 rpm unless indicated otherwise.

D. Pump Capacity: Shall be no less than the values listed on the Mechanical Equipment

Schedule on the drawings.

E. Pump Types: The type of each pump is indicated on the Mechanical Equipment Schedule under the "Type" column, and corresponds to the types specified herein.

F. Motors: Shall comply with Section 200500. Motors shall be of sufficient size so as to be non-overloading at any point on the operating curve and shall be no smaller than the size shown on the drawings. Motors shall be of drip-proof construction (unless indicated otherwise), resilient mounted with oil lubricated journal or ball bearings, and have built-in thermal overload protectors. Motors shall be for use with the voltage and phase as scheduled on the drawings.

G. Domestic Water Applications: Pumps used on domestic water systems shall be of all-bronze construction, and NSF certified for domestic water use.

H. Testing: All pumps shall be factory tested per the Hydraulic Institute standards and be thoroughly cleaned.

I. Finish: Pumps shall have minimum one coat high grade machinery enamel finish, factory applied, manufacturer's standard color.

J. Nameplate: Pumps shall have stamped metal nameplates identifying: manufacturer, model number, capacity (gpm and head), and date of manufacturer.

K. Variable Speed Application: Pumps used with variable speed drives shall have motors that are compatible with the variable frequency drive unit and shall have suitable couplings and accessories to suit variable speed duty.

2.3 DOMESTIC CIRCULATORS

A. Type: Centrifugal, single stage, close coupled, in-line pump for domestic water circulation. Bell & Gossett Series PL (or approved).

B. Operating Range: Pump shall be rated for continuous operation at 150 psi working pressure and 225 deg F.

C. Construction: Bronze body, mechanical carbon/silicon carbide seal system, stainless steel face plate, and permanently lubricated sealed bearings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps at locations shown on the drawings.

B. Decrease from line size to pump inlet size with long radius reducing elbows and minimum 5-pipe diameter straight pipe into pump. Where reducers (in the horizontal) are used on pumps, they shall be the eccentric type installed with taper on the bottom.

C. Check motor alignment after pump installation, re-align as necessary.

D. Check pump operation to ensure that specified flows are provided, without motor

unloading or pump cavitation. Notify the Architect/Engineer of any unusual conditions or performance other than as specified.

3.2 COMMISSIONING

A. Selected Division 22 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221123

SECTION 221300 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Soil, Waste and Vent Piping.

B. Condensate, Overflow, Miscellaneous Drains.

C. Cleanouts.

D. Testing and Inspection.

E. Accessories.

1.3 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data: Submit product information on all items to be used.

1.4 REFERENCES

A. ASME B 16.4: Gray Iron Threaded Fittings.

B. ASME B 16.12: Cast Iron Threaded Drainage Fittings.

C. ASME B 16.15: Cast Bronze Threaded Fitting Classes 125 and 250.

D. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

E. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

F. ASME B 16.23: Cast Copper Alloy Solder Drainage Fittings.

G. ASME B 16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).

H. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

I. ASTM A 74: Cast Iron Soil Pipe and Fittings.

J. ASTM A 888: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

K. ASTM B 32: Solder Metal.

L. ASTM B 88: Seamless Copper Water Tube.

M. ASTM B 306: Copper Drainage Tube (DWV).

N. ASTM C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

O. ASTM C 1277: Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

P. ASTM D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

Q. ASTM D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

R. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

S. ASTM D 2447: Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

T. ASTM D 2466: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

U. ASTM D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

V. ASTM D 2657: Heat Fusion Joining or Polyolefin Pipe and Fittings.

W. ASTM D 2661: Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

X. ASTM D 2665: Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

Y. ASTM D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

Z. ASTM D 2843: Density of Smoke from the Burning or Decomposition of Plastics.

AA. ASTM D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

BB. ASTM D 3212: Joints for Drains and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

CC. ASTM D 3311: Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

DD. ASTM D 4101: Polypropylene Injection and Extrusion Materials.

EE. ASTM F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

FF. ASTM F 628: Co-extruded Acrylonitrile-Butadiene-Styrene (ABS) Pipe with Cellular Core.

GG. ASTM F 891: Co-extruded Poly(Vinyl Chloride) (PVC) Pipe with Cellular Core.

HH. CISPI 301: Hubless Iron Soil Pipe and Fittings for Sanitary and Drain, Waste, and Vent Piping Applications.

II. CISPI 310: Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, 2.1, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. No Hub Couplings: ANACO, Mission Rubber, Tyler, MG Coupling, Fernco, Clamp-All.

D. Cleanouts: Josam, Zurn, J.R. Smith, Wade.

2.2 PIPE AND FITTINGS - MATERIALS

A. No-Hub Cast Iron Pipe and Fittings:

1. Pipe and Fittings: Service weight no-hub cast iron pipe and cast iron fittings, per CISPI 301 and ASTM A 888, for use with mechanical no-hub couplings.
2. Couplings: Per CISPI 310 or ASTM C 1277, with a cast iron or stainless shield, and neoprene gasket per ASTM C 564.
3. Heavy Duty Couplings:

a. Heavy duty clamp type coupling, with stainless steel shield minimum 0.015-inch thick, stainless steel clamps, stainless steel screws minimum 0.375-inch nominal diameter, gasket per ASTM C 564, and minimum 4 clamps each coupling. ANACO Husky SD 4000.
b. Heavy duty cast iron constructed clamp, two piece, with stainless nuts/bolts, neoprene gasket per ASTM C 564. MG Piping Products “MG Coupling”.

B. Hub and Spigot Cast Iron Pipe and Fittings: Service weight hub and spigot cast iron pipe and cast iron fittings per ASTM A 74, for use with compression gaskets. Gaskets shall conform to ASTM C 564.

C. Copper DWV Pipe and Fittings: Copper drainage tube per ASTM B 306. Wrought copper and wrought copper alloy solder joint fittings per ASME B 16.29; or cast copper alloy solder joint fittings per ASME B 16.23.

D. Galvanized Steel DWV Pipe and Fittings: Schedule 40 galvanized steel pipe per ASTM A 53, Grade B, Type 5. Cast iron drainage fittings, threaded, per ASME B 16.12; and cast iron screwed fittings per ASME B 16.4.

E. Copper Pipe and Fittings: Seamless copper water tube, tube L or M, per ASTM B 88. Solder joint wrought copper and bronze fittings per ASME B 16.22 cast copper alloy

fittings per ASME B 16.18, and cast bronze threaded fittings per ASME B 16.15 with 95/5 tin-antimony solder per ASTM B 32.

F. PVC DWV Pipe and Fittings: Polyvinyl chloride drain pipe, solid wall pipe per ASTM D 1785 and ASTM D 2665 with solvent cement joints. Foam (i.e. cellular) core pipe NOT allowed. Polyvinyl chloride DWV fittings conforming to ASTM D 2665 or ASDTM F 1866, with solvent cement joints. Solvent cement shall comply with ASTM D 2564.

G. PVC Pipe and Fittings: Polyvinyl chloride pipe, schedule 40, per ASTM D 1785. Polyvinyl chloride solvent cement socket type fittings conforming to ASTM D 2466. Solvent cement shall comply with ASTM D 2564.

H. ABS DWV Pipe and Fittings: Acrylonitrile-butadiene-styrene plastic drain pipe, solid wall pipe per ASTM D 2661 with solvent cement joints. Foam (i.e. cellular) core pipe NOT allowed. Acrylonitrile-butadiene-styrene DWV fittings conforming to ASTM D 2661 or ASTM D 3311. Solvent cement shall comply with ASTM D 2235.

2.3 PIPE AND FITTINGS – APPLICATION

A. Waste and Vent:

1. Piping 2-1/2 Inches and Smaller Located Above Ground: Galvanized steel DWV, no-hub cast iron, or copper DWV.
2. Piping 3 Inches and Larger Located Above Ground: No-hub cast iron, bell and spigot cast iron, copper DWV.
3. All Piping Located Below Ground: No-hub cast iron, bell and spigot cast iron, copper DWV, or ABS DWV.
4. High Temperature: Waste piping serving fixtures that may receive waste greater than 120 degree F. shall be no-hub cast iron, bell and spigot cast iron, or copper DWV for minimum 40 feet downstream of fixture (i.e. dishwasher, three compartment sink, drains/receptors serving water heater and steam generator, and similar items).
5. Piping Exposed to Temperatures Above 130 deg F: Galvanized steel DWV or no-hub cast iron.
6. No-Hub Couplings: Couplings on below ground piping shall be the heavy duty type.

B. Reverse Osmosis/Pure Water Fixture Drains: Schedule 40 PVC.

C. Cooling Condensate Drains: Copper DWV, copper, PVC DWV, or PVC except where exposed shall be copper.

D. Kitchen Indirect Drains: Copper DWV, copper.

E. Miscellaneous Drains: Copper DWV, copper, PVC DWV, or PVC; except that for corrosive fluids (or corrosive fluid venting) applications use the same materials as specified for the acid waste (or vent) systems, or use PVC.

F. Piping Exposed in Finished Areas: Chrome or nickel plated brass; piping 2 inches and larger may be provided with chrome or nickel plated brass sleeves to conceal pipe and fittings.

2.4 CLEANOUTS

A. General:

1. All cleanouts shall have cast iron bodies with bronze countersunk rectangular slotted plugs, lubricated with a non-hardening teflon base thread lubricant and having a gasket seal.
2. Cleanouts located in waterproof membrane floors shall be provided with an integral cast flange and flashing device.
3. All cleanouts shall be the same size as the pipe which they are intended to serve (but not larger than 4-inch).
4. Pipe fittings for cleanouts which turn through walls or up through floors shall use long sweep ells or a "Y" and 1/8 bend.
5. All cleanouts and access covers shall be provided with vandal proof screws.

B. Floor Cleanouts:

1. Areas Without Carpet: J.R. Smith No. 4100 Series adjustable floor cleanout with round heavy duty nickel bronze top.
2. Areas With Carpet: J.R. Smith 4020-X Series adjustable floor level cleanout with round heavy duty nickel bronze top and carpet clamp.

C. Wall Cleanouts: Cast iron ferrule with cast bronze taper threaded plug, with plug tapped 1/4-inch, 20 thread, to accept access cover screw; with stainless steel access cover and vandal proof screw.

D. Outside Cleanouts: Heavy duty, round, cast iron, double-flanged housing, having scoriated cast iron cover with lifting device, ferrule and bronze closure plug. Housing and lid shall be galvanized and have vandal resistant screws. J.R. Smith No. 4251 or 4256 Series.

2.5 ACCESSORIES

A. Vent Flashing:

1. General: Style and type to suit roofing system, match vent pipe size, and provide waterproof building penetration. Provide with adequate base size for proper flashing into roof system.
2. EPDM or compression molded rubber; suitable for temperatures from -60 deg F to 270 deg F; resistant to ozone and UV light. Flashing shall have aluminum or galvanized steel base for flashing or attachment to roof (style to suit roof type). Provide stainless steel clamp.
3. 2.5 lb sheet lead, extending as a sleeve all around vent pipe with base extended out minimum 10 inches all around; top counter-flashing overlap 2" and turned down inside vent pipe.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of all items shall comply with code, best professional practices,

manufacturers written installation instructions, and to allow for proper functioning of items being connected to.

B. Provide all piping as indicated and as required to allow complete and proper waste, drain, and vent connections to each fixture and equipment item requiring connection. Provide offsets as required to accommodate building construction and access requirements per Section 200500. For multistory buildings include costs to offset vertical piping through each floor level since structural member locations will not be the same on each floor.

C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. The work of this section shall include all waste (sanitary sewer), drain, and vent lines inside of the building and 5-feet outside of the building (unless indicated otherwise), to the point of and including connections to outside sanitary sewer lines or sanitary sewer manholes.

E. Consult manufacturer's data and architectural drawings for information on plumbing fixtures before beginning rough-in.

F. Verify points of connection, invert elevations, and grade requirements before beginning installation or ordering materials.

G. Stub all piping for all items requiring connections through wall or floor; cap and protect until connection to items is complete.

H. Vents extending through roof shall terminate at least 10 inches above roofing; and not less than 10 feet from and 3 feet above any building opening. Provide vent flashing at each vent through roof; utilize water-proof method as required to best suit roofing material and roofing system manufacturer.

I. Trap all fixtures and equipment items as required by governing code; provide proper venting for each trap.

J. Provide drain piping for all unit condensate drains, unit P-traps, etc. Run piping to nearest point of drainage, or as shown on drawings. Where routing is not shown, route to nearest point of proper drainage.

K. Provide piping connections to equipment furnished by others in accordance with Section 200500.

L. All excavation, trenching and backfilling shall comply with code and pipe manufacturers recommendations. Below ground plastic pipe installation shall comply with ASTM D 2321 and shall exceed those standards as specified.

3.2 PIPE AND FITTINGS

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping so as not to obstruct access to any items requiring routine service,

maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur. Prior to running any piping, confirm with Architect/Engineer (unless is clearly noted to be ran exposed). Install exposed piping so as not to obstruct any portion of windows, doors, doorways, passageways, or items requiring service or access.

C. Consult all drawings for location of pipe spaces, ducts, electrical equipment, structural elements, ceiling heights, door items requiring access, openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Install all horizontal soil or waste lines with a slope of 1/4-inch per foot unless noted otherwise. Coordinate with AHJ if written approval is required for exceptions to 1/4-inch per foot slope.

E. Make all changes of direction and junctions with Y fittings and 1/8 bends; use sanitary tee fittings in vertical pipe only.

F. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

G. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

H. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, but are required per this paragraph.

I. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

J. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

K. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

L. ABS Pipe:

1. General: Plastic pipe couplings and fittings shall be handled and installed in accordance with manufacturer's written instructions and code.
2. Solvent Joints: The outside of the pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.
3. Plastic to Metal Connections: Work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.3 INSTALLATION OF CLEANOUTS

A. Install cleanouts in all soil and waste piping:

1. As shown on drawings;
2. At no more than 30 foot intervals on horizontal runs per Owner's Standards (whether shown on drawings or not);
3. At the end of all piping runs;
4. At the base of all vertical risers.
5. At all changes of direction for a run of 10 feet or over;
6. At all locations shown on the drawings and where needed to correct possible stoppage and as required by governing code.

B. Where cleanouts occur in concealed spaces provided extensions to floors above or to walls to allow access.

C. Provide wall access covers or access doors for all wall cleanouts. See Section 201519 for access doors.

D. Floor cleanouts shall be installed so as to be flush with the finished floor; where recessed cleanout covers are used the recess shall be filled flush with material to match the surrounding finished floor.

E. Install cleanouts so as to assure proper clearances as required by governing code.

F. All cleanouts located outside shall be provided with an access housing located in a 24" x 24" x 6" thick concrete pad, flush with the adjacent finished grade. The pipe and cleanout shall be independent of this access housing and pad.

3.4 TESTING AND INSPECTION

A. All piping shall be tested, inspected and approved prior to being concealed or covered.

B. Testing shall be by water or air, and comply with code.

C. Testing shall be witnessed by the code official, the Owner's representative (at their option), and the Engineer (at their option). Prior to beginning testing confirm with the Owner and Engineer their level of involvement in the testing process and extent of witnessing; where they will be witnessing the testing notify them at least 72 hours in advance of the test and confirm their availability; coordinate and reschedule as necessary and arrange mutually agreed upon times for the tests and witnessing to occur.

D. Water Testing:

1. Fill system with water so that there is no less than 10 feet of head above the highest system section being tested.
2. System shall hold pressure for a period of at least 15 minutes with no leakage before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

E. Air Testing:

1. Pressurize system with air so that there is no less than 5 psig of air pressure in the system.
2. System shall hold pressure for a period of at least 15 minutes without the introduction of additional air before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

F. All leaks shall be eliminated and the system re-tested before proceeding with work or concealing pipe.

G. All repairs to piping shall be with new material and no caulking of screwed joints or holes is allowed.

END OF SECTION 221300

SECTION 221400 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Storm Drainage Piping.

B. Roof Drains.

C. Area Drains.

D. Testing and Inspection.

1.3 SUBMITTALS

A. Submittals shall comply with Section 200500.

B. Submit product information on all items to be used.

1.4 REFERENCES

A. ASME B 16.4: Gray Iron Threaded Fittings.

B. ASME B 16.12: Cast Iron Threaded Drainage Fittings.

C. ASME B 16.15: Cast Bronze Threaded Fitting Classes 125 and 250.

D. ASME B 16.18: Cast Copper Alloy Solder Joint Pressure Fittings.

E. ASME B 16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

F. ASME B 16.23: Cast Copper Alloy Solder Drainage Fittings.

G. ASME B 16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).

H. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

I. ASTM A 74: Cast Iron Soil Pipe and Fittings.

J. ASTM A 888: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

K. ASTM B 32: Solder Metal.

L. ASTM B 88: Seamless Copper Water Tube.

M. ASTM B 306: Copper Drainage Tube (DWV).

N. ASTM C 564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

O. ASTM C 1277: Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

P. ASTM D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

Q. ASTM D 2661: Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

R. ASTM D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

S. ASTM D 3212: Joints for Drains and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

T. ASTM D 3311: Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

U. ASTM F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

V. CISPI 301: Hubless Iron Soil Pipe and Fittings for Sanitary and Drain, Waste, and Vent Piping Applications.

W. CISPI 310: Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic manufacturers only.

C. No-Hub Couplings: MG Couplings, Husky, Fernco, Tyler.

D. Roof and Area Drains: J.R. Smith; Wade; Zurn; Jonespec.

2.2 PIPE AND FITTINGS - MATERIALS

A. No-Hub Cast Iron Pipe and Fittings:

1. Pipe and Fittings: Service weight no-hub cast iron pipe and cast iron fittings, per CISPI 301 and ASTM A 888, for use with mechanical no-hub couplings.
2. Couplings: Per CISPI 310 or ASTM C 1277, with a cast iron or stainless shield, and neoprene gasket per ASTM C 564.
3. Heavy Duty Couplings:

a. Heavy duty clamp type coupling, with stainless steel shield minimum

0.015-inch thick, stainless steel clamps, stainless steel screws minimum 0.375-inch nominal diameter, gasket per ASTM C 564, and minimum 4 clamps each coupling. ANACO Husky SD 4000.

b. Heavy duty cast iron constructed clamp, two piece, with stainless nuts/bolts, neoprene gasket per ASTM C 564. MG Piping Products "MG Coupling".

B. Hub and Spigot Cast Iron Pipe and Fittings: Service weight hub and spigot cast iron pipe and cast iron fittings per ASTM A 74, for use with compression gaskets. Gaskets shall conform to ASTM C 564.

C. Copper DWV Pipe and Fittings: Copper drainage tube per ASTM B 306. Wrought copper and wrought copper alloy solder joint fittings per ASME B 16.29; or cast copper alloy solder joint fittings per ASME B 16.23.

D. Galvanized Steel DWV Pipe and Fittings: Schedule 40 galvanized steel pipe per ASTM A 53, Grade B, Type 5. Cast iron drainage fittings, threaded, per ASME B 16.12; and cast iron screwed fittings per ASME B 16.4.

E. Copper Pipe and Fittings: Seamless copper water tube, tube L or M, per ASTM B 88. Solder joint wrought copper and bronze fittings per ASME B 16.22 cast copper alloy fittings per ASME B 16.18, and cast bronze threaded fittings per ASME B 16.15 with 95/5 tin-antimony solder per ASTM B 32.

F. ABS DWV Pipe and Fittings: Acrylonitrile-butadiene-styrene plastic drain pipe, solid wall pipe per ASTM D 2661 with solvent cement joints. Foam (i.e. cellular) core pipe NOT allowed. Acrylonitrile-butadiene-styrene DWV fittings conforming to ASTM D 2661 or ASTM D 3311. Solvent cement shall comply with ASTM D 2235.

2.3 PIPE AND FITTINGS - APPLICATION

A. Roof and Area Piping:

1. Piping 2-1/2 Inches and Smaller Located Above Ground: Galvanized steel DWV, no-hub cast iron, copper DWV.
2. Piping 3 Inches and Larger Located Above Ground: No-hub cast iron, bell and spigot cast iron, copper DWV.
3. All Piping Located Below Ground: No-hub cast iron, bell and spigot cast iron, copper DWV, or ABS DWV.

B. Piping Exposed in Finished Areas: Chrome or nickel plated brass; piping 2 inches and larger may be provided with chrome or nickel plated brass sleeves to conceal pipe and fittings.

2.4 ROOF DRAINS

A. General: Products are specified below by reference numbers corresponding to the reference number adjoining these items on the drawings.

B. Construction: Roof drains shall have cast iron body, with polyethylene coated cast iron dome, flashing clamp ring, under deck clamp, sump receiver, extension (to suit roof), and expansion joint. Drain pipe connection type shall suit piping material used with.

C. RD-1 Roof Drain: J.R. Smith No. 1015 roof drain, with adjustable extension (to suit roof).

D. RD-2 Overflow Roof Drain: J.R. Smith No. 1080 overflow roof drain with 2" high water dam.

E. RD-3 Roof Drain: Same as RD-1 except provide with custom fabricated flat perforated strainer in lieu of dome strainer.

F. RD-4 Overflow Roof Drain: Same as RD-2 except provide with custom fabricated flat perforated strainer in lieu of dome strainer.

G. Overflow Nozzles: J.R. Smith No. 1770, cast bronze overflow nozzle, with wall flange.

H. Expansion Joints: Neoprene or thermoplastic rubber flexible bellows type, with stainless steel bands for attachment to gutter or roof drains and rainleaders. Plumbing Specialties T0300 Series, or approved. In lieu of flexible bellows type, slide type having cast iron body with bronze sleeve and packing gland (J.R. Smith Figure 1710, or approved) may be used.

2.5 CLEANOUTS

A. General:

1. All cleanouts shall have cast iron bodies with bronze countersunk rectangular slotted plugs, lubricated with a non-hardening teflon base thread lubricant.
2. Cleanouts located in waterproof membrane floor shall be provided with an integral cast flange and flashing device.
3. All cleanouts shall be the same size as the pipe which they are intended to serve (but no larger than 4 inch).
4. Pipe fittings for cleanouts which turn through walls or up through floors shall use long sweep ells or a "Y" and 1/8 bend.
5. All cleanouts and access covers shall be provided with vandal proof screws.

B. Floor Cleanouts: J.R. Smith No. 4100 Series adjustable floor cleanout with round heavy duty nickel bronze top.

C. Wall Cleanouts: Cast iron ferrule with cast bronze taper threaded plug, with plug tapped 1/4-inch 20 thread, to accept access cover screw; with stainless steel access cover and vandal proof screw.

D. Outside Cleanouts: Heavy duty, round, cast iron, double-flanged housing, having scoriated cast iron cover with lifting device, ferrule and bronze closure plug. Housing and lid shall be galvanized and have vandal resistant screws. J.R. Smith No. 4251 or 4256 Series.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.

B. Provide all piping as indicated and as required to allow complete and proper drain connections to each drain and item requiring connection.

C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. The work of this section shall include all interior storm drain piping, roof drains, and area drains inside of the building and 5-feet outside of the building (unless indicated otherwise), to the point of and including connections to outside storm drainage piping or storm sewer manholes.

E. Consult manufacturer's data and architectural drawings for information on drains before beginning rough-in. Verify suitability for area(s) to be installed in before ordering, and that all necessary options and accessories are provided.

F. Verify points of connection, invert elevations, and grade requirements before beginning installation or ordering materials.

G. Stub all piping for all items requiring connections through roof or floor; cap and protect until connection to items is complete.

H. Provide piping connections to equipment furnished by others in accordance with Section 200500.

I. All excavation, trenching and backfilling shall comply with Section 200590.

3.2 PIPE AND FITTINGS

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping so as not to obstruct access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur. Prior to running any piping exposed, confirm with Architect/Engineer (unless piping is clearly and specifically noted to be ran exposed). Install exposed piping so as not to obstruct any portion of windows, doors, doorways, passageways, or items requiring service or access.

C. Consult all drawings for location or pipe spaces, ducts, electrical equipment, ceiling heights, items requiring access, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Install all horizontal drain lines with a slope of 1/4-inch per foot unless noted otherwise.

E. Make all changes of direction and junctions with Y fittings and 1/8 bends; use sanitary tee fittings in vertical pipe only.

F. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

G. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

H. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offset are typically not shown on the plans, but are required per this paragraph.

I. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by piping and fitting manufacturer.

J. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

K. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

L. ABS Pipe:

1. General: Plastic pipe couplings and fittings shall be handled and installed in accordance with manufacturer's written instructions and code.
2. Solvent Joints: The outside of the pipe shall be chamfered to a minimum of 1/6 inch at approximately 22 degrees. Chemicals used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.
3. On plastic to metal connections, work the metal connection first. Use a non-hardening compound on threaded connections. Use only light wrench pressure. Connections between metal and plastic are to be threaded utilizing female threaded adapters only, not male adapters.

3.3 INSTALLATION OF CLEANOUTS

A. Install cleanouts in all soil and waste piping:

1. At no more than 30 foot intervals on horizontal runs.
2. At the end of all piping runs.
3. At the base of all vertical risers.
4. At all changes of direction for a run of 10 feet or over.
5. At all locations shown on the drawings and where needed to correct possible stoppage and as required by governing code.

B. Where cleanouts occur in concealed spaces provided extensions to floors above or to walls to allow access.

C. Provide wall access covers or access doors for all wall cleanouts. See Section 200511 for access doors.

D. Floor cleanouts shall be installed so as to be flush with the finished floor; where recessed cleanout covers are used the recess shall be filled flush with material to match the surrounding finished floor.

E. Install cleanouts so as to assure proper clearances as required by governing code.

F. All cleanouts located outside shall be provided with an access housing located in a 24" x 24" x 6" thick concrete pad, flush with the adjacent finished grade. The pipe and cleanout shall be independent of this access housing and pad.

3.4 TESTING AND INSPECTION

A. All piping shall be tested, inspected and approved prior to being concealed or covered.

B. Testing shall be by water or air, and shall comply with governing code.

C. Testing shall be witnessed by the plumbing inspector and the Engineer's representative.

D. Water Testing:

1. Fill system with water so that there is no less than 10 feet of head above the highest system section being tested.
2. System shall hold pressure for a period of at least 15 minutes with no leakage before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

E. Air Testing:

1. Pressurize system with air so that there is no less than 5 psig of air pressure in the system.
2. System shall hold pressure for a period of at least 15 minutes without the introduction of additional air before the inspection starts.
3. The system shall be inspected and shall hold tight with no leakage at all points.

F. All leaks shall be eliminated and the system re-tested before proceeding with work or concealing pipe.

G. All repairs to piping shall be with new material and no caulking of screwed joints or holes is allowed.

END OF SECTION 221400

SECTION 221500 - COMPRESSED-AIR SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Compressed Air System Piping.

B. Valves.

C. Air Compressors.

D. Air Dryers.

E. Receivers.

F. Air Filters.

G. Accessories.

1.3 SUBMITTALS

A. Product Data: Submit product information for all items to be used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only; US Steel, Pioneer Pipe, Mueller, Cerro, Anvil International.

C. Valves: Conbraco/Apollo, Nibco, Stockham, Walworth, Milwaukee, Kitz, Red-White, Watts, Hammond.

D. Air Compressors: Champion, Quincy, Atlas Copco, Kellogg, Sullair, Ingersoll-Rand.

E. Air Dryers: Great Lakes, Wilkerson, Kellogg, Ingersoll-Rand.

F. Air Filters: Kaeser, Ingersoll-Rand, Wilkerson.

G. Compressed Air Accessories: Norgren, Wilkerson, Dynaquip, Balcrank, Hannax, Arrow, Ingersoll-Rand, Kaeser.

2.2 PIPE AND FITTINGS - MATERIALS

A. Steel Pipe and Fittings:

1. Pipe: Black steel pipe, per ASTM A 53, Type E or S, Grade A or B, Schedule 40 unless indicated otherwise.
2. Fittings:

a. Threaded: Malleable iron fittings per ASME B16.3.
b. Welded: Steel weld fittings per ASTM A 234; butt weld type per ASME B16.9; socket weld type per ASME B16.11.
c. Flanged: Fittings, bolts, nuts, and bolt patterns per ASME B16.5, Class 150. Flanges shall comply with ASTM A105. Bolts shall be high strength or intermediate strength, with material conforming to ASTM A193.

3. Threads: Shall conform to ASME B1.20.1

B. Copper Pipe and Fittings:

1. Pipe: Seamless copper water tube, hard temper (unless noted otherwise), type K, per ASTM B88.
2. Fittings:

a. Brazed Joint: Wrought copper and bronze fittings per ASME B16.22 and cast copper alloy fittings per ASME B16.18, cast bronze threaded fittings per ASME B16.15.
b. Flanged: Cast bronze fittings per ASME B16.24.
c. Brazing Material: AWS A5.8, BCuP-5.

2.3 PIPE AND FITTINGS – APPLICATIONS

A. Shop Areas: Piping exposed in shop areas and where subject to physical damage shall be steel.

B. Non-Shop Areas: Piping in non-shop areas and where ran concealed may be steel or copper.

2.4 VALVES

A. Valves: 150 psi-swp bronze ball, standard port, 3 piece construction, blowout-proof stem, Teflon seats, threaded ends. Nibco No. T-590.

B. Pressure Regulating Valves: Body shall be of aluminum or zinc construction, with aluminum and nylon valve assembly, Buna-N elastomer, T-handle or know adjustment with locknut, wall mounting bracket, and integral pressure gauge. Regulator shall be rated for 300 psig maximum inlet pressure, and up to 175 degree F temperatures. Regulator shall be relieving type and shall be adjustable from 15 to 250 psig. Provide regulator with main ports same size as piping regulator is connected to.

2.5 AIR COMPRESSOR

A. Type: Packaged single stage direct drive oil-free scroll type.

B. General: Compressor units shall be factory assembled and run tested, self-contained readily transported unit complete with interconnecting tubing, wiring, and all accessories including those not specifically mentioned herein but required so as to be complete and ready for operation except for external connection of electrical piping and control services.

C. Capacity: Compressor shall have a capacity no less than that indicated on the plans and be capable of operating at full capacity up to 150 psig or as low as 100 psig. Unit shall be rated in accordance with CAGI standards.

D. Electrical: Compressor shall be for use with electrical power as indicated on the plans. Unit shall have single point electrical connection, and be provided with necessary transformers for control circuit or other devices. Unit shall be furnished with all necessary starters.

E. Finish: Unit shall be factory shop primed and finished with manufacturers standard enamel paint.

F. Enclosure: Unit shall be complete with weatherproof acoustic enclosure.

G. Compressor Construction:

1. General: Compressor shall consist of helical rotors constructed of steel alloy, with bearings on discharge and suction ends to contain axial and radial loads and allow for thermal expansion.
2. Unloaders: Provide compressor with automatic blowdown valve to release pressure on receiver/separator to allow for unloaded starting.
3. Modulating Control: Provide compressor with modulating valve to vary air flow through compressor in response to receiver pressure so as to allow continuous compressor operation with output following system usage and thereby minimizing compressor start/stops and pressure variations. In addition, provide with unloading capability to unload compressor at low demand to allow reduced horsepower consumption at low usage. Unit shall have time delay shut-down to automatically shut unit down after operating unloaded for 10 minutes (shall be adjustable), and shall automatically restart upon system pressure drop. Modulating valve action in response to receiver pressure shall be adjustable.
4. Oil Free: Shall be Class Zero per standard ISO 8573-1 (2010).
5. Safety Controls: Provide unit with the following manual reset safety devices to automatically shut down the unit in the event of high discharge air temperature.
6. Drive: Compressor shall be direct driven.
7. Mounting: Compressor, motor, and all related components shall be mounted on vibration isolators.
8. Motors: Shall be totally enclosed fan cooled energy efficient type. Motors shall conform to ANSI/NEMA MG 1 for Design B motors, and have Class B or better insulation. Motors shall have thermal overload protection, be U.L. listed, and comply with Section 220500.

H. Aftercooler:

1. Type: Air cooled type, with propeller type fan and guard.
2. Capacity: Aftercooler shall be sized to cool discharge air to within 10 degrees of ambient air temperature, with compressors operating at specified capacity.

I. Controls:

1. Motor Starters: Provide each compressor with fused magnetic motor starter and "hand-off-auto" switch. In "auto" position, unit shall be controlled by unit's pressure switch. In "off" position unit shall be off. In "hand" position unit shall bypass remote controls and shall run off units own pressure controls only. Mount starters on each compressor and wire to motor and pressure controls.
2. Control Panels: Shall be NEMA 1 type, hinged; all lights shall be push to test type; all devices shall be industrial heavy duty type.
3. Provide on control panel on each unit the following:

    a. Green pilot light indicating "compressor run".
    b. Hour meter indicating compressor run time.
    c. Red pilot light indicating safety shutdown (due to any safety control).
    d. Orange pilot light indicating standby operation.
    e. Hand-Off-Auto switch (see paragraph entitled "Motor-Starters").
    f. Red emergency stop push button (mushroom type).
    g. Safety device reset push button.

4. Pressure Controls: Provide start-stop pressure switches, set to provide air within a 150 to 100 psig range. Pressure switch set points shall be adjustable. Provide quantity and arrangement of pressure switches to allow proper unit operation.
5. Labeling: Provide nameplates for control panel and all control devices (including all pressure switches, relays, motor starters, etc.) indicating device name and application. Nameplates shall have minimum 1/8-inch high lettering, engraved on laminated plastic. Laminated plastic shall have black surface layer and white sub-layer, with engraving through to expose white sub-layer.

J. Integral Air Dryer:

1. Type: Refrigerated type.
2. Capacity: As indicated on the plans.
3. Construction: Reciprocating or scroll type compressor with refrigeration circuit, and accessories to cool air to dew point noted.
4. The dryer shall be provided with an automatic condensate drain trap.

K. Integral Receiver

1. Type: Steel ASME code constructed combination receiver, rated for 200 psig.
2. Configuration: Receiver shall have at least four base legs for floor anchoring.
3. Trim: Unit shall include ASME Code safety relief valve set at 200 psig, and pressure gauge.

2.6 AIR FILTERS

A. General: Body constructed of aluminum or steel, with powder coat paint finish, metal bowl with sight glass, differential pressure indicator, and wall mounting bracket. Filters shall be manual drain type, except for filters at regulators (and where indicated), which shall be automatic drain type. Filter shall be rated for 250 psig.

B. Type: Main filters shall be particulate type with manual drains. Secondary filters shall be oil removing (coalescing) type with automatic drain.

C. Sizing: Filters shall be sized with main ports the same size as the connecting pipe indicated on the plans Filter shall have capacity to handle cfm noted on plans with pressure drop no greater than 5 psi.

D. Filter Efficiency: Provide quantity and efficiency of main and secondary filters to work in combination to provide the following ISO 8573.1 Quality Class: Class 1 for solid particles; Class 1 for oil.

2.7 ACCESSORIES

A. Quick-Connect Couplings:

1. Female: Air couplers designed for quick connection of air equipment. Coupler shall have steel rollers to grip male plug, swivel for free 360 degree rotation, and automatic valve in socket to prevent loss of air when disconnected. Couplers shall have Buna-N seals and be rated for 300 psi maximum pressure. Verify type and connection sizes.
2. Male: Air coupler type to fit female quick-connect coupling as specified above.

B. Automatic Drain: Designed for compressed air service, rated for minimum 175 psig, with body constructed of semi-steel, with stainless steel ball float. Drain shall automatically open to drain off condensate, shall seal tight to prevent leakage of compressed air.

C. Pressure Gauges: See Section 200511.

D. Flexible Connectors: See Section 200511.

E. Hose Reel: Heavy duty compressed air hose reel, with 25-foot, 1/2-inch inside diameter hose, hose stop, spring driven auto rewind, and female quick connect coupler. Unit shall have heavy duty 1/4-inch plate steel support post and plate, full flow swivel joint, roller hose guides, and latching ratchet. Hose and fittings shall be rated for 300 psi minimum at 150 deg F. Unit shall have powder coat paint finish. Provide with air gun outlet. Coxreel TSH series. (Addendum 3)

PART 3 - EXECUTION

3.1 GENERAL

A. Installation: Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices.

B. Coordination: Coordinate the work with all trades that may be affected by the work to

avoid conflicts and to allow for an organized and efficient installation of all systems. Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

C. Complete System: Provide all piping, fittings, and components indicated to provide a complete and operational compressed air system. Provide piping connection to each item requiring compressed air.

3.2 PIPE AND FITTINGS

A. General:

1. All piping in finished areas shall be installed concealed unless specifically noted otherwise.
2. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur.
3. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Rack piping aligned with adjacent piping. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

B. System Drainage: All air piping shall be sloped at a minimum rate of 1/4-inch per ten feet (unless indicated otherwise) to a point of drainage. Where automatic drains are not shown at low points, provide manual drain valves; terminate at floor drains or exterior of the building.

C. Escutcheons: Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

D. Electrical Items: Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary.

E. Joints: Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs, and piping prepared as recommended by piping and fitting manufacturer.

F. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

G. Soldered Connections: Polish contact surfaces of fittings and pipes with emery cloth before fluxing male and female surfaces of joints. Steel wool and sandpaper not permitted for polishing.

H. Unions: Install unions in pipe connections to filters, pressure regulators, equipment and other items where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated. Where flanged connections occur at equipment additional unions are not required unless indicated otherwise.

I. Insulating Unions: Install dielectric insulating unions or insulating type flexible connectors between all connections of copper piping and steel piping of steel equipment. Where flanged connections occur use insulating type flanges.

3.3 VALVES

A. General: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed toward operator in either the vertical or horizontal direction. Provide access doors for valves not otherwise accessible.

B. Pressure Regulators: Provide pressure regulating valves with isolation valves, unions, and pressure gauges. Set initial pressure and adjust as required so that devices served have sufficient air pressure.

3.4 EQUIPMENT

A. Compressors: Install compressors with vibration isolators. Provide flexible connector in piping connection to air compressor. Pipe unit automatic tank drain to floor drain.

B. Anchorage: Anchor all equipment and receivers to building.

C. Receivers: Pipe receiver drain to floor drain or other acceptable point of drainage.

3.5 AIR FILTERS AND ACCESSORIES

A. Air Outlets: Provide air outlets types as indicated. Provide air outlets with isolation valve, dirt leg, and accessories as indicated.

B. Air Filters: Provide in piping system as indicated.

3.6 TESTING AND INSPECTION

A. All piping shall be tested, inspected, and approved by the authority having jurisdiction prior to being concealed or covered.

B. Testing shall be witnessed by the Architect/Engineer (at his option). Notify Architect/Engineer minimum 72 hours prior to date of testing, and mutually agreed upon times arranged.

C. Testing: The entire compressed air system with all outlets in place shall be tested with 150 psi compressed air over a 24-hour period. Inspect system for signs of leakage. There shall be no pressure drop other than due to temperature changes.

D. Any leaks or defective piping disclosed by testing and inspection shall be repaired with new materials and the system re-tested.

E. Provide documentation to Engineer indicating that the system has been completely pressure tested, and all portions inspected and accepted by the authority having jurisdiction.

END OF SECTION 221500

SECTION 223300 - DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Water Heaters.

1.3 REFERENCES

A. Boiler Code: State of Washington Boilers and Unfired Pressure Vessel Laws, Chapter 70.79 RCW, Chapter 296-104 WAC.

B. NSF 61: Drinking Water System Components – Health Effects.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for all items to be used.

B. Manufacturer's Instructions: Submit manufacturer's installation instructions for water heaters.

1.5 GENERAL REQUIREMENTS

A. NSF: Manufacturers shall fabricate and label equipment components that will be in contact with potable water per NSF 61.

B. Quality Assurance: Provide quality assurance checks specified in Section 200500 prior to ordering products.

C. Code Compliance: Water heater efficiency and insulation levels shall comply with code. Provide water heater with accessories (i.e. heat traps, relief valves, etc.) as required by code.

D. Temperature Settings: Water heaters shall be able to be set at a leaving (or system) water temperature over a range. Low setting shall be at least 90 degrees F or 10 degrees F lower than the system water temperature indicated on the plans (whichever is lower). High setting shall be at least 10 degrees higher than the system water temperature indicated on the plans.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Water Heaters – Tank Type: A.O. Smith, Rheem, Bradford-White, State, PVI.

2.2 WATER HEATERS – TANK ELECTRIC

A. Type: Tank type electric water heater, constructed in accordance with ASME code, UL listed, and NSF approved. A.O. Smith DVE series (or approved).

B. Capacity: Shall have capacity as indicated on the drawings.

C. Tank and Insulation: Tank shall be of steel construction, constructed and stamped in accordance with ASME code for a minimum working pressure of 125 psi at maximum water heater operating temperature. All internal tank surfaces shall be glass coated; glass coating shall be an alkaline borosilicate composition, fused to tank by firing at a high temperature. Tank shall be insulated with foam to comply with local code requirements and no less than ASHRAE 90.1 (latest edition) for insulating rating and tank heat loss. Tank and insulation shall be fully enclosed within a steel enclosure having a baked on enamel finish and hinged access door to access unit controls and wiring.

D. Cathodic Protection: Tank shall be cathodically protected with an extruded magnesium rod, full size of unit, selected by manufacture to suit typical water conditions at the installation general location and adequate to last the tank warranty period. Rod shall be removable through top of tank.

E. Immersion Heaters: Minimum of three elements per immersion heater, incoloy sheathed, flange mounted and with factory wired terminal leads.

F. Accessories: Water heater shall have brass drain valve with 3/4-inch hose thread male outlet and an ASME rated pressure and temperature relief valve.

G. Electrical and Controls: Water heater shall be rated for use with electrical power of the voltage and phase as scheduled. Water heater shall have necessary contactors, controls, and safeties to control water heater temperature to within 5 degrees of value set. Contactors shall be magnetic type, rated for minimum 100,000 cycles. Unit shall have element fusing as required by local code and the NEC. Water heater control circuit shall be 120 or 24 volt, and unit shall have an integral control circuit transformer with fusing. Thermostat shall be the immersion type, shall control water heater temperature and be able to be set over a range. Water heater shall have a manual reset high limit to stop water heater operation at a high unsafe temperature. All wiring shall be color coded and labeled for ease of service.

H. Warranty: Tank shall be warranted to be free from defects for three years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with Section 200500. In accordance with manufacturer's written installation instructions, code, applicable standards, and best construction practices.

B. Coordination: Coordinate the work with all trades that may be affected by the work to avoid conflicts and to allow for an organized and efficient installation of all systems.

C. Connections: Connect and install all items shipped loose with equipment and as needed for proper system operation. Provide and connect all utilities and services to equipment as required for proper equipment and system operation.

D. Protection, Operation and Maintenance: Comply with Section 200500. Protect water heaters against use and damage during construction; provide guards and/or boxing as required.

E. Relief Valves: Pipe all pressure relief valves to proper point of drainage.

F. Clearances: Provide as required for maintenance or as required by Code; whichever is greater. Water heater sizes exceeding any of the following shall have minimum 18" clearance all around (or as required by Boiler Code for boilers; whichever is greater): 120 gallons, 160 psi, or 200,000 BTU/hr input.

G. Anchorage: Provide seismic strapping and anchorage of water heater to building structure.

H. Inspection: Inspect water heaters and connecting systems to confirm water heaters and system are ready for start-up and operation. As a minimum, check for: proper voltage and phase, correct gas pressure and regulator setting (for gas fired units), correct electrical connections, complete control connections, relief valve correctly sized and discharge piped, drain provisions installed, valving to water heater accessible and ready to be set in operating positions, and other items as listed by the manufacturer are properly provided and connected.

I. Start-Up and Adjustment: Put water heater into service following manufacturer start-up procedures. Adjust water heaters for proper operation; set thermostats for required supply temperature. Check operation of water heater by flowing water and confirming proper operation.

3.2 COMMISSIONING

A. Selected Division 22 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Plumbing Fixtures and Trim.

B. Installation/Connection of Equipment Specified Elsewhere.

C. Adjustment and Cleaning.

1.3 DEFINITIONS

A. "Plumbing Brass" means "P-traps, stops, strainers, tailpieces, flanges, and other brass fittings and accessories NOT including faucets or stops."

B. "Trim" includes all plumbing brass items, faucets, and any fixture accessories.

C. "Accessible" refers to the American's with Disabilities Act, and infers that these fixtures will meet Federal and local code requirements.

D. "Lead-Free" means not containing more than 0.2% lead in solder and flux; and not more than a weighted average of 0.25% lead in wetted surfaces of pipes, pipe and plumbing fittings and fixtures.

1.4 REFERENCES

A. UPC: Uniform Plumbing Code.

B. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects.

1.5 SUBMITTALS

A. General: All submittals shall comply with Section 200500.

B. Product Data: Submit product data for all plumbing fixtures, plumbing trim, and water heaters.

C. Mounting Heights: Submit list of mounting heights to be used for all fixtures.

D. ADA Accessibility: Submit list (or plans) of which fixtures will be ADA accessible; indicated by room number and location; indicate how accessibility is achieved (i.e. side approach) where not readily obvious.

E. Cabinet Coordination: Submit list (or plans) of all fixtures that will be installed in cabinets, list fixture size, indicate minimum cabinet clearances required, indicate cabinet size available, indicate if there is a clearance problem and if so the proposed resolution.

1.6 GENERAL REQUIREMENTS

A. Fixture Quality: Provide new fixtures and fittings, approved, free from flaws and blemishes with finished surfaces clear, smooth and bright. Visible parts of fixture brass and accessories, and all items located in accessible cabinet spaces, shall be heavily chrome plated. All stops, P-traps and items exposed to view shall be chrome plated (except where specifically noted otherwise).

B. Code Compliance: All products and connections shall be in compliance with code, local Utilities Department standards, and Health Department requirements.

C. Off-The-Floor Mounted Fixtures - Movement:

1. General: Off-the-floor (i.e. wall) mounted fixtures shall be supported, anchored, and braced in a manner so that the fixture does not move more than the values indicated below with the imposed forces as indicated; nor shall the fixture or associated fittings leak or suffer damage of any kind. Deflection shall be measured at the front most part of the fixture (i.e. the point on the fixture furthest away from the wall containing the fixture supports), with the load imposed at the same location as the measured deflection. Deflection shall not be exceeded in any direction with the force imposed in any direction.
2. Water Closets: 1/16-inch with a 300 pound force.
3. Other Fixtures: 1/16-inch with a 150 pound force.

~~D. Spare Parts: Provide two spare stop valves.~~

D. Spare Parts:

1. Provide two spare stop valves.
2. Provide six spare drinking fountain filters. (Addendum 1)

1.7 QUALITY ASSURANCE

A. General: Provide quality assurance checks specified in Section 200500 prior to submitting product data. By submitting products for Engineer's review, the Contractor is confirming that such checks have been performed and that the products are suitable for the intended installation and use.

B. Fixtures:

1. Types: Verify specified fixture types with the Architectural and Plumbing drawings to confirm the requirements are consistent (e.g. fixtures are wall mounted versus floor mounted type, locations of ADA fixtures match, etc.). Where conflicts occur clearly identify the issue on the fixture submittal along with a proposed resolution; or resolve prior to making the submittal by the project RFI process.
2. Space Verification: Prior to ordering any fixtures or making submittals,

Contractor shall check the drawings and verify that all fixtures will fit the space available (i.e. fixtures fit any cabinets fixtures are to be installed in; fixtures have adequate access clearances for proper use; etc.).

C. Lead-Free Requirement: All items in contact with potable water shall be lead free. Fixtures used to dispense potable water for drinking shall meet the requirements of NSF/ANSI 61.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Water Closets: Kohler, American Standard, Sloan, Eljer, Mansfield.

C. Vitreous china (other than water closets) and enameled cast iron fixtures: American Standard; Kohler, Eljer, Mansfield.

D. Water Closet Seats: Church; Beneke; Olsonite; Kohler; Bemis.

E. Carriers: Josam; J.R. Smith; Wade; Zurn.

F. Ligature Resistant Fixtures: Whitehall or approved equal.

G. Stainless Steel Sinks: Just; Elkay, Franke.

H. Service Sinks: Fiat; Stern and Williams; Swan; Kohler; Mustee.

I. Drinking Fountains: Haws; Elkay; Murdoch.

J. Hydrants and Hose Bibbs: J.R. Smith; Zurn; Josam.

K. Floor Drains and Floor Receptors: J.R. Smith; Zurn; Josam; Mifab.

L. Plumbing Brass: American Standard; Brasscraft; Chicago Faucet; Crane; Eljer; Frost; Kohler; Speakman; Symmons; T & S Brass; McGuire; Elkay.

M. Faucets: Chicago Faucet or approved equal.

N. Stops: Brasscraft or approved equal.

O. Flush Valves: Sloan, Zurn.

P. Shower Faucets: Chicago Faucet; Symmons (no substitutions).

Q. Safety Fixtures: Haws, Guardian Equipment, Lawler, Acorn Safety.

R. Hot Water Temperature Limiting Valve: Symmons, Watts, Chicago Faucet, Acorn Controls, Leonard.

2.2 PLUMBING FIXTURES

A. General:

1. Plumbing Fixtures are listed below by reference numbers, corresponding to the reference number adjoining these items on the drawings.
2. All vitreous china and enameled cast iron fixtures shall be finished white unless specifically noted otherwise.
3. All stainless steel sinks shall be sound deadened, and shall have faucet ledge (except where noted specifically without ledge).
4. In interests of Owner's Standardization, fixtures of similar type shall be product of one manufacturer; trim of similar type shall be product of one manufacturer.

B. Water Closets:

P-1A Water Closet - Floor Mount - ADA:

Water Closet: American Standard “Huron”, No. 3312, vitreous china, elongated bowl, floor mounted, siphon jet action bowl with 1-1/2" top spud, and 1.28/1.6 gallon flush.

Flush Valve: Sloan "Ecos” 8111 chrome-plated dual flush sensor operated flush valve with vacuum breaker, 1.6 or 1.1 gallon per flush based on time period with dual flush override buttons, quiet-action, and screw driver stop, battery operated.

Seat: Kohler “Lustra”, No. K-4670-SC, white plastic elongated seat, open-front and stainless steel self-sustaining check hinge.

ADA: Configure and install for ADA access. Verify with Architectural drawings for mounting heights and off-center stall dimensions. Provide with flush valve so that handle is on wide side of stall.

P-1B Water Closet - Floor Mount – ADA -Ligature Resistant

Water Closet: Whitehall Model No. WH2142-ADA-W-EGE10, ligature resistant, type 304 stainless steel with exterior surfaces powder coated, elongated bowl, floor mounted, siphon jet action bowl with 1-1/2" rear spud, and 1.6 gallon flush.

Flush Valve: Sloan "Regal XL Optima” 1.52-1.6 chrome-plated, sensor operated flush valve with override button, vacuum breaker, quiet-action, and screw driver stop, 115 to 24 volt transformer and valve box.

Seat: Whitehall Model No. WH-LRSC-GRAY ligature resistant ABS toilet seat cover.

ADA: Configure and install for ADA access. Verify with Architectural drawings for mounting heights and off-center stall dimensions. Provide with flush valve so that handle is on wide side of stall.

C. Lavatories:

P-3A Lavatory - Wall Hung - ADA:

Lavatory: Kohler “Kingston”, No. K-2007, 21" x 18", vitreous china lavatory with single faucet opening, for use with concealed arm carrier.

Plumbing Brass: Kohler No. K-7129 lavatory drain with perforated grate and 1-1/4" tailpiece; Kohler No. 9000 1-1/4" cast brass "P" trap with cleanout; stops and risers per "Specialties" in this specification section.

Faucet: Chicago Faucet No. 116-203-AB-4 sensor faucet, 0.35 GPM spout outlet/aerator, single supply for tempered water, 6 volt lithium battery.

Hot Water Temperature Limiting Valve: Thermostatic water temperature mixing valve with integral checks, complying with ASSE 1070 and UPC Chapter 4. Brass body with brass and stainless steel internal components. Leonard "ECO-Mix" 270 / Symmons "Maxline" Model 5-210.

P-3B Lavatory – Wall Hung – ADA – Ligature Resistant:

Lavatory: Whitehall Model No. WH-3774-WH3374L ligature resistant, wall-mounted lavatory, solid surface polymer resin construction, drilled for 4" on center faucet

Plumbing Brass: Perforated grate integral to lavatory; stops and risers per "Specialties" in this specification section.

Faucet: Whitehall Model No. WH3377 ligature resistant faucet with air control metering pushbuttons, 0.35 gpm vandal resistant aerator, 4" on center

Hot Water Temperature Limiting Valve: Thermostatic water temperature mixing valve with integral checks, complying with ASSE 1070 and UPC Chapter 4. Brass body with brass and stainless steel internal components. Leonard "ECO-Mix" 270 / Symmons "Maxline" Model 5-210.

D. Sinks:

P-5A Sink:

Sink: Elkay No. LRAD2219 multi-hole drill, 18 gauge, type 304, stainless steel, 19-1/2" front to back x 22" left to right x 7-1/2" deep self-rimming sink with rear faucet ledge.

Plumbing Brass: Elkay stainless steel cup strainer with 1-1/2" tailpiece and 1-1/2" cast brass "P" trap with cleanout; stops and risers per "Specialties" in this specifications section.

Faucet: Chicago Faucet No. 2302-GN8AE73ABCP deck mount single hole spout with side valve lever handle for water mixing; 8" rigid/swing gooseneck spout, 1.0gpm pressure compensated outlet.

P-5B Sink:

Sink: Elkay No. LRAD 292265, dual compartment, multi-hole drill, 18 gauge, type 304, stainless steel, 22" front to back x 29" left to right x 6-1/2" deep self–rimming sink with rear faucet ledge.

Plumbing Brass: Elkay stainless steel cup strainers with 1-1/2" tailpieces and 1-1/2" cast brass "P" trap with cleanout; stops and risers per "Specialties" in this specifications

section.

Faucet: Chicago Faucet No. 2302-GN8AE73ABCP deck mount single hole spout with side valve lever handle for water mixing; 8" rigid/swing gooseneck spout, 1.0gpm pressure compensated outlet.

P-5C Sink:

Sink: Elkay No. ELUHAD191655 undercounter sink, 18 gauge, type 304, stainless steel, 18-1/2" front to back x 21-1/2" left to right x 5-3/8" deep self-rimming sink.

Plumbing Brass: Elkay stainless steel cup strainer with 1-1/2" tailpiece and 1-1/2" cast brass "P" trap with cleanout; stops and risers per "Specialties" in this specifications section.

Faucet: Chicago Faucet No. 2302-GN8AE73ABCP deck mount single hole spout with side valve lever handle for water mixing; 8" rigid/swing gooseneck spout, 1.0gpm pressure compensated outlet.

P-5D Sink:

Sink: Integral to countertop. See architectural drawings and specifications.

Faucet: Chicago Faucet No. 1100-GN8AE35-317AB deck mount, 8" on center with 8" gooseneck spout and wristblade handles, 1.5gpm aerator.

P-5E Clinic Sink:

Sink: American Standard Model No. 9512 vitreous china, wall hung, clinic service sink with top inlet, wall outlet.

Flush Valve: Sloan "Royal" 117 chrome-plated manual flush valve with vacuum breaker, 6.5 gallon per flush and screw driver stop.

Faucet: Chicago Faucet No. 923-ASAABCP wall mount pre-rinse fitting, 23" riser with spring guide, stainless steel hose with insulated handle, 1.25 gpm spray valve, pipe strap and sprayer hook.

E. Service Sinks:

P-6A Service Sink - Floor Mount:

Sink: Mustee No. 63M molded fiberglass sink basin, 24" x 24" x 10" high, color white, with minimum 30" long heavy duty reinforced 5/8" diameter flexible hose for connection to 3/4" hose thread, spring loaded stainless steel hose bracket, vinyl rim guards.

Plumbing Brass: Combination dome strainer and lint bucket of minimum 16 gauge 302 stainless steel, with stainless steel screws and 3" drain connection.

Faucet: Chicago Faucet No. 897 combination service sink fitting with 3/4" hose thread on spout, No. 369 handles, wall brace, pail hook, No. R-1/2" flanged female adjustable arms, integral stops, polished chrome-plated.

F. Drinking Fountains/Bottle Fillers:

P-8A Drinking Fountain and Bottle Filling - ADA:

Drinking Fountain: Elkay Model No. LZWS-EDFPBM117K barrier-free, hand-free, dual height drinking fountain, stainless steel, sensor operated, pliable polyester elastomer bubbler, anti-splash ridge, cabinet located automatic stream height regulator screwdriver stop, waste strainer, and 1-1/4" O.D. tailpiece. Sensor operated, filtered, bottle filling station with LED interface display, 120 volt/1 phase. Provide with top and bottom acce3ss panels, and inlet filter certified to NSF/ANSI 42 and 53, rated for 3000 gallons.

G. Shower:

P-9A Shower - ADA:

Enclosure: See architectural specifications.

Shower Unit: See architectural specifications.

H. Hydrants and Hose Bibbs:

P-10A Wall Hydrant - Non-Freeze:

J.R. Smith No. 5519 recessed box type wall hydrant, non-freeze type, with polished bronze box and bronze hinged cover, bronze hydrant and casing, integral vacuum breaker, "T" handle key and 3/4" inlet, 3/4" hose outlet, and overall depth to suit wall thickness and provide suitable freeze protection.

P-10B Wall Hydrant - Interior:

Woodford No. B24 Series recessed box type wall hydrant, brass casting with chrome finish, hinged cover, 3/4" hose connection, vacuum breaker, and metal wheel handle. 4 Hydrant shall fit within a wall thickness of 4".

P-10C Wall Hydrant - Twin Temperature Non-Freeze:

Zurn No. Z-1325 dual temperature recessed box wall hydrant, non-freeze type, with polished bronze box and bronze hinged cover, integral vacuum breaker, "T" handle key and 3/4 inch inlets, 3/4 inch hose outlet, and overall depth to suit wall thickness and provide suitable freeze protection.

I. Floor Drains:

P-11A Floor Drain:

J.R. Smith No. 2010-A cast iron body floor drain, with nickel bronze adjustable strainer head, round nickel bronze grate, vandal proof screws, reversible flashing collar, and trap primer connection. Size drain outlet to match pipe size shown on drawings.

P-11B Funnel Floor Drain:

Same as P-11A but with 6" diameter nickel bronze top funnel (No. 3581). Cut out strainer inside of funnel to prevent splashing.

P-11C Floor Receptor:

J.R. Smith Figure 3100 series, enamel coated floor receptor, 10" deep, with 12" square nickel bronze half grate and rim, sediment bucket, trap primer connection, vandal-proof screws. Size outlet to match pipe size noted on drawings.

P-11D Hub Drain:

With trap primer connection and p-trap size as noted on drawings.

P-11E Funnel Drain:

J. R. Smith No. 3821 cast iron condensate funnel drain, with 6" diameter funnel. P-trap size as noted on drawings.

P-11S Floor Receptor – Stainless Steel:

J.R. Smith Figure 9693 series, 14 gauge stainless floor receptor, 10" deep, with 12" square stinless half grate and rim, sediment bucket, trap primer connection, vandal-proof screws. Size outlet to match pipe size noted on drawings. See Food Service drawings for grate configurations.

P-11D Hub Drain:

J. Wall Box Fittings:

P-12A Washer/Dryer Fitting:

Guy Gray Model No. BB 200TS, 18 gauge steel cover and box, top supply, 1/2" connections, hot water and cold water valves having 3/4" hose bibb outlets, 2" drain pipe outlet with washer and locknut, and overflow lip. Caulk inside seam and screw holes to 1/2 inch above flood rim of overflow lip.

P-12B Refrigerator Box:

Guy Gray Model BIM875 stainless steel rough-in box with angle valve (1/2-inch inlet, 1/4-inch compression outlet).

K. Safety Fixtures:

P-13A Emergency Eyewash/Shower - Barrier Free:

Shower: Haws No. 8309WC horizontal drench shower, with ABS plastic shower head, chrome plated brass ball valve, rigid stainless steel pull cord, galvanized steel piping, self-closing spring for valve, and universal emergency sign. Emergency eyewash shall have stainless steel receptor, eye/face wash head, dust cover, instant action chrome plated brass ball valve, stainless steel push flag, wall mounting bracket, and sign. Eyewash to

be plumbed for ADA accessibility.

Shower Bracket: Chrome plated clamp, rod, wall bracket, and accessories for supporting shower piping.

Mixing Valve: Bronze body thermostatic mixing valve with outlet temperature gauge. All components in contact with water shall be corrosion resistant. Valve shall be rated for 125 psig, and be furnished with inlet check valves. Valve shall be for use with hot water from 110 deg F to 180 deg F, and cold water from 35 deg F to 60 deg F. Valve shall maintain supply setpoint plus/minus 5 deg. F, with up to 30 deg. F changes in entering water temperatures and up to a 50% drop in supply pressures. Shall be set for 80 deg. F. Shall be fail-safe operation to prevent scalding. Unit shall be sized and selected by emergency fixture manufacturer to provide adequate flow as required by fixture(s) served. Provide with isolation valves on supply piping to mixing valve.

P-13B Emergency Eyewash - ADA:

Eyewash: Haws No. 7360BTWC barrier free wall mounted emergency eye and face wash, with stainless steel receptor, eye/face wash head, dust cover, instant action chrome plated brass ball valve, stainless steel push flag, wall mounting bracket, and sign. Eyewash to be plumbed for ADA accessibility.

Mixing Valve: Bronze body thermostatic mixing valve with outlet temperature gauge. All components in contact with water shall be corrosion resistant. Valve shall be rated for 125 psig, and be furnished with inlet check valves. Valve shall be for use with hot water from 110 deg F to 180 deg F, and cold water from 35 deg F to 60 deg F. Valve shall maintain supply setpoint plus/minus 5 deg. F, with up to 30 deg. F changes in entering water temperatures and up to a 50% drop in supply pressures. Shall be set for 80 deg. F. Shall be fail-safe operation to prevent scalding. Unit shall be sized and selected by emergency fixture manufacturer to provide adequate flow as required by fixture(s) served. Provide with isolation valves on supply piping to mixing valve.

P-13C Emergency Eyewash – Counter-mounted - Barrier Free

Haws No. 7610 barrier free sink/countertop mounted eye and face wash with inverted laminar flow, anti-microbial treated eye/face wash head, and dust cover; polished chrome plated brass single action pull-down valve body, with universal emergency sign.

Mixing Valve: Bronze body thermostatic mixing valve with outlet temperature gauge. All components in contact with water shall be corrosion resistant. Valve shall be rated for 125 psig, and be furnished with inlet check valves. Valve shall be for use with hot water from 110 deg F to 180 deg F, and cold water from 35 deg F to 60 deg F. Valve shall maintain supply setpoint plus/minus 5 deg. F, with up to 30 deg. F changes in entering water temperatures and up to a 50% drop in supply pressures. Shall be set for 80 deg. F. Shall be fail-safe operation to prevent scalding. Unit shall be sized and selected by emergency fixture manufacturer to provide adequate flow as required by fixture(s) served. Provide with isolation valves on supply piping to mixing valve.

2.3 OFF-THE-FLOOR FIXTURE SUPPORTS (CARRIERS)

A. General: Type to suit fixture and building construction, with added anchors, bracing, wall

backing and accessories to comply with maximum specified fixture movement. Concealed in wall. Provide with all hardware and accessories for proper fixture support to suit the application. See Section 200529 for hangers and supports.

B. Water Closets: Cast iron or steel construction, adjustable to support fixture, with positive sealing gasket fabricated of closed cell neoprene. Provide with rear anchoring lug on single units. J.R. Smith 100, 200 and 300 series with added anchors and accessories to comply with maximum specified fixture movement.

C. Urinals: Steel construction, with high strength steel uprights welded to 4-inch square steel base plates for floor anchoring, top and bottom fixture support and bearing plates, adjustable. J.R. Smith Figure 635 and 637 with added anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement.

D. Lavatories: Steel construction, with 1-inch x 3-inch rectangular steel uprights welded to 4-inch square steel base plates for floor anchoring, and arms for lavatory support. J.R. Smith Figure 700 and 710 with added anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement.

E. Other Fixtures: Manufacturers' standard carrier to suite fixture and application, steel construction with anchors, bracing, wall backing and accessories to comply with maximum specified fixture movement.

F. Non-Standard Fixtures: For fixtures that standard carriers are not manufactured for provide 3/16" thick steel back plate for block walls and wood stud walls; or a 2" x 2" x 1/4" angle welded to at least four studs for metal stud walls, with through bolts and fasteners to support fixture and comply with maximum specified fixture movement.

2.4 SPECIALTIES

A. General: Unless indicated otherwise, the following fittings and materials (i.e. specialties) shall be used.

B. Fixture Traps: 17 gage seamless chrome plated cast brass tubing, with 2 inch minimum seal, and cleanout, size as required by Uniform Plumbing Code (unless a larger size is indicated), and configured to suit the application.

C. Exposed Piping and Fittings: In finished areas and in accessible cabinets, provide piping with chrome plating or sleeved with chromed sleeves or of stainless steel construction/finish; all chrome to have a bright polished finish. No exposed copper allowed (includes accessible cabinet areas).

D. Stops: Quarter turn ball valve with loose key, size as required. Brasscraft only.

E. Risers: Flexible braided steel type; rated for 125 psig.

F. Escutcheons: See Section 200519.

G. Wall Box: 20 gauge hot dipped galvanized steel box with 18 gauge face plate, 1/2" inlet x 1/4" outlet compression angle valve. Guy Gray Model BIM875.

H. Hot Water Temperature Limiting Valve: Thermostatic water temperature mixing valve with integral checks, complying with ASSE 1070 and UPC Chapter 4. Brass body with brass and stainless steel internal components. Leonard "ECO-Mix" 270 / Symmons "Maxline" Model 5-210.

I. Sealant: See Section 200530. Sealant at fixtures shall be the silicone type, color to match fixture.

2.5 FOOD SERVICE ITEMS AND EQUIPMENT SPECIFIED ELSEWHERE

A. Food Service Equipment: Refer to the kitchen equipment schedule, kitchen (or food service) equipment specifications, and kitchen (or food service) drawings. Under this Section of the specifications provide all plumbing services (HW, CW, drain lines, etc.), provide all plumbing fixtures, and install/furnish those items indicated to be Mechanical (M), Plumbing (P), or by Divisions 20, 22, or 23.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIXTURES

A. General: All fixtures shall be completely connected to piping as needed to make a complete and operable installation.

B. Fixture Locations: Mounting heights and locations of fixtures shall be as shown on the Architectural drawings and in accordance with Contract Document requirements. Locations shall be verified and coordinated with the various trades affected by the installation of these fixtures. When no indicated or shown, obtain mounting location and heights from the Architect/Engineer prior to installation.

C. Rough-In: Determine rough-in location of fixture utilities to suit fixture location, fixture dimensions, elements of construction (i.e. beams, studs, electrical, ducts, etc.), access requirements, casework dimensions, items which may drain/connect to fixture, use of fixture, and related considerations. The fixture rough-in locations indicated on the plans is schematic, and is not to be used for final rough-in purposes.

D. Offsets: Provide offsets in piping to fixtures to accommodate building systems. Such offsets shall include off-setting waste piping into cabinet bases (in kick space where possible) to accommodate beams located directly below walls behind fixtures.

E. Carriers: All off-the-floor (i.e. wall) mounted fixtures shall be installed with supporting carriers and additional anchors, bracing and supports to transmit fixture loads to the floor and building structure without exceeding the maximum specified fixture movement. Prior to concealing carrier and associated supports review adequacy of support system with Architect/Engineer.

F. Fixture Sealant: Where fixtures abut to walls, floors, and cabinets seal all joints with a uniform fillet bead of sealant. Provide at other locations as recommended by fixture manufacturer.

G. Protection: Protect fixtures against use and damage until project substantial completion; provide guards and/or boxing to protect.

3.2 INSTALLATION OF SPECIALTIES

A. Escutcheons: Provide escutcheons at each point where an exposed pipe or other fitting passes through walls, floors, backs of cabinets, or ceilings.

B. Stops: Provide stops in water connections to all fixtures/equipment, except where a stop valve is integral to the fixture (e.g. flush valves) and in water connections to all items not served by another valve.

C. Hot Water Temperature Limiting Valve: Install on all lavatories, bathtubs, showers, whirlpools, bidets and as fixtures required by Code (reference UPC Chapter 4); set for 115 deg F maximum delivery temperature. Test and adjust for proper operation and submit written report documenting work performed.

3.3 INSTALLATION OF EQUIPMENT SPECIFIED ELSEWHERE

A. General: Refer to the drawing schedules, architectural specifications and related information in the Contract Documents. Under this section of the specifications provide and install and/or connect all plumbing services indicated to be by Mechanical (M), Plumbing (P), or by Divisions 20, 22, or 23.

B. Installation: Comply with installation requirements for fixtures and specialties per this specification Section.

C. Complete Connections: Provide all water supply stops and appurtenances necessary to make a complete installation of items. All lines between the stops and fixtures/equipment shall be hard piped, chrome plated and sized as indicated (or, where not sized, size per the UPC or manufacturer).

D. Exposed: All waste, drain, indirect drain, and traps shall exposed to view shall be chrome plated or sleeved with chromed sleeves.

3.4 ADJUSTMENT AND CLEANING

A. Cleaning: After completion of installation remove all labels and thoroughly clean all fixtures, trim and fittings.

B. Adjustment: Adjust all flush valves, fixture stops, faucets, valves, and associated plumbing items as necessary for the proper operation of all fixtures and equipment.

END OF SECTION 224000

SECTION 230594 - INDOOR AIR QUALITY ASSURANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Building Outdoor Air Flush Out.

B. Documentation.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with the overall project schedule to insure that the initial building flush out occurs prior to substantial completion.

B. Air quality assurance flush-out periods shall appear as milestones on Contractor's CPM schedule.

C. Notify Owner at least 14 days in advance of proposed flush-out periods.

D. Adjust all outdoor air dampers, return air dampers, exhaust air dampers, fans, controls, system components, and building features (doors, door openers, windows, vents, etc.) so as to allow the use of 100% outdoor air without causing harmful pressure gradients, damage due to low or high temperatures, damage due to rate of change of temperature/pressures, or other similar problems in the building. If the outdoor air temperature is such that freezing of coils or other items is possible, adjust the outdoor air dampers to increase temperatures to prevent such problems. Coordinate such concerns and revisions with the Architect/Engineer. Heating and cooling systems shall be operable during flushout periods.

E. Flush-out shall comply with USGBC LEED requirements.

3.2 FLUSH OUT PERIODS

A. Initial Building Flush Out: Prior to substantial completion, but after completion of all interior construction finishes (trim, carpeting, painting, etc.) operate the building's HVAC systems on 100% outdoor air for a period of 14 days (or a minimum of 3,500 cfm per square foot of floor area, whichever is greater) to completely flush the building's air. Systems shall operate 24 hours/day, with thermostats set to maintain space temperatures

between 60 and 80 degrees F. Promptly change out all system filters after this flush out period, and reset all adjusted items for normal operation.

B. Final Building Flush Out: After substantial completion and after all furniture has been installed (unpacked and located), operate the building's HVAC systems on 100% outdoor air for an additional period of 7days. Systems shall operate 16 hours/day (evening to morning hours), with thermostats set to maintain space temperatures between 60 and 80 degrees F. Adjust system for normal, specified operation for 8 hours (normal, daytime, occupied hours). Promptly change out all system filters after this flush out period, and reset all adjusted items for normal operation.

3.3 DOCUMENTATION

A. Provide written records documenting the dates and times when the flush out periods occurred, equipment that was operated, any significant system adjustments made to allow the flush out, general weather conditions and indoor conditions observed during the flush out periods. Provide a signed copy (by the individual responsible for overseeing the Project with the General Contractor) of such documentation to the Architect/Engineer, Owner, and a copy in the O&M Manual.

B. Ensure that periods satisfy the requirements for LEED Indoor Environmental Quality Credit 3. In addition, Contractor shall provide photographs of equipment during flushout.

3.4 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Division 01 and Section 230800. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications. In many cases, this shall require the Contractor to create or otherwise provide procedures and checklists for approval by the Commissioning Consultant prior to the start of functional testing.

END OF SECTION 230594

SECTION 23 08 00 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following section specifies general commissioning activities for this project:

01 91 13 GENERAL COMMISSIONING REQUIREMENTS

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

All HVAC Systems

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Commissioning General Requirements, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified 01 91 13, Commissioning General Requirements, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed.

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Dedicated Outdoor Air System						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
VRFZ Indoor Units with Economizer						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
VRFZ Outdoor Units						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Split System AC Units						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Makeup Air Unit						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Kitchen Exhaust Fan						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Unit Heaters						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Paddle Fans						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Ductwork Systems						
Ductwork Pressure Test						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
VRFZ Control System						
Graphical interface plan						
Point-to-point and sensor calibration verification		CxA Provided				
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

SAMPLE

Contractor Checklist

Unit Type:	**VRF Fan Coil Unit**	Unit No:	
Location:		Serves:	
Manufacturer:		Model:	

Check	RC	CxA	Note
Equipment			
Area is cleaned and clear of construction debris			
Unit is clean and has no visible physical damage			
Equipment labels are installed per project documents			
Unit is accessible for service			
Mounting is appropriate with vibration isolation as specified			
Accessibility and condition of air filter			
Accessibility and condition of coil			
Accessibility and condition of fan motor			
Piping			
Refrigerant piping is complete			
Refrigerant piping is insulated			
Condensate drain installed with p-trap, clean out & piped to drain -or-			
Unit equipped with condensate pumping system piped to drain			
Condensate pump wired and powered up			
Ductwork			
Associated duct work is complete			
Diffuser locations per project documents			
Control Devices			
Control wires and devices are complete			
Control wire and devices are labeled per project documents			
BAS sensor installed and in appropriate location			
Thermostat installed and in appropriate location			
Electrical			
Supply power is installed and disconnect is accessible			
Disconnect is labeled			
Nameplate Minimum Circuit Amps			
Nameplate Maximum Overcurrent Protection Device Amps			
Installed overload			
Overloads and/or fusing is appropriate			
Convenience outlet within 50’ of equipment			
Start-Up			
Manufacturer’s installation and start-up procedures complete			
Start-up documentation submitted to CxA			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SAMPLE

Contractor Checklist

Unit Type:	**VRF Outdoor Unit**	Unit No:	
Location:		Serves:	
Manufacturer:		Model:	

Check	RC	CxA	Note
Equipment			
Area is cleaned and clear of construction debris			
Unit is clean and has no visible physical damage			
Equipment labels are installed per project documents			
Unit is accessible for service			
Mounting is appropriate with vibration isolation as specified			
Accessibility and condition of outdoor coil			
Accessibility and condition of fan and motor			
Piping			
Refrigeration piping complete with valves, sensors, strainers, filter driers and sight glasses			
Refrigerant piping is insulated			
Control Devices			
Control wires and devices are complete			
Control wire and devices are labeled per project documents			
Electrical			
Supply power is installed and disconnect is accessible			
Disconnect is labeled			
Nameplate Minimum Circuit Amps			
Nameplate Maximum Overcurrent Protection Device Amps			
Installed overload			
Overloads and/or fusing is appropriate			
Convenience outlet within 50’ of equipment			
Start-Up			
Manufacturer’s installation and start-up procedures complete			
Start-up documentation submitted to CxA			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor shall be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that shall be conducted on this project. This table shall be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table shall be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A System Description	B Responsible Contractor	C Proposed Test Forms Received	D OK	E Testing Complete	F OK	G Notes
Dedicated Outdoor Air Units						
VRFZ System						
Split System AC						
Make up air unit						
Kitchen exhaust						
Unit heaters						
Paddle fans						
Air Distribution System						
VRFZ Control System						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Dedicated Outdoor Unit
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

Functional Tests:

1) Unit Operation
   a) Demonstrate operation of all features and functions
   b) Simulate all alarm conditions and demonstrate all safeties and alarm reporting.
   c) Demonstrate freeze protection mode in hand and auto
   d) Demonstrate smoke detector shutdown in hand and auto
   e) Demonstrate fan HOA functions
   f) Demonstrate modulation and temperature control.
   g) Demonstrate EMCS Interface

VRFZ System (VRFZ Certified Installer)
Indoor Units, Outdoor Units, BC Controllers, Control System
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

Functional Tests:

1) Unit Operation
   a) Demonstrate operation of all features and functions
   b) Simulate all alarm conditions and demonstrate all safeties and alarm reporting.
   c) Demonstrate fan HOA functions
   d) Demonstrate modulation and temperature control.
   e) Demonstrate EMCS Interface
   f) Demonstrate condensate pump operation

Split System AC Units
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix - B details the various methods of accomplishing functional testing.

Preliminary Activities:

The contractor shall be responsible for marking the motorized smoke control damper shaft ends with the damper blade orientation and providing access (ladders, lifts, etc.) to the motorized dampers during testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

Functional Tests:

1) Operation of all features
2) Cooling
3) Temperature Control
4) Scheduling
5) Alarms
6) Condensate pump and/or drain

Make-Up Air Unit
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CA Will Sample or Witness
C.1	CA	Contractor	N/A	Up to 100%

Functional Tests:

1) Unit Operation
   a) Demonstrate and document operation of all features and functions
   b) Simulate all alarm conditions and demonstrate and document all safeties and alarm reporting.
   c) Demonstrate and document smoke detector shutdown in hand and auto
   d) Demonstrate and document fan HOA functions
   e) Demonstrate and document modulation and temperature control.
   f) Demonstrate and document BCS Interface

Kitchen Hood System
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix B details the various methods of accomplishing functional testing.

Test Method E – CC Written, Contractor Conducts, CC Witness

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CA Will Sample or Witness
C.1	CA	Contractor	N/A	Up to 100%

Functional Tests:

Demonstrate and document and document the proper operation of the following:

1) All monitoring and Alarming Functions
2) Fire Suppression Certification
3) Smoke/Steam removal effectiveness

Unit Heaters
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix - B details the various methods of accomplishing functional testing.

Preliminary Activities:

The contractor will be responsible for marking the motorized smoke control damper shaft ends with the damper blade orientation and providing access (ladders, lifts, etc.) to the motorized dampers during testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CA Will Sample or Witness
C.1	CA	Contractor	N/A	Up to 100%

Functional Tests:

1) Unit Operation
   a) Demonstrate and document operation of all features and functions.
   b) Simulate alarm conditions and demonstrate and document all safeties and alarm reporting.
   c) Demonstrate and document modulation and temperature control.
   d) Demonstrate and document BCS Interface.

Paddle Fans
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

Functional Tests:

1) Exhaust fans
   a) Demonstrate operation of all features.
   b) Demonstrate on/off control and any interlocks.
   c) Demonstrate building control system Interface.

Air Distribution Systems
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Preliminary Activities:

The contractor shall be responsible for marking the motorized smoke control damper shaft ends with the damper blade orientation and providing access (ladders, lifts, etc.) to the motorized dampers during testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

Fire and Smoke Control
1) Demonstrate and document the operation (open/close) of all motorized Fire/Smoke Dampers.

Variable Refrigerant Flow Zoning (VRFZ) Control System
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Preliminary Activities:

A Controls Integration Meeting (CIM) shall be conducted after the controls submittal is complete and the CxA has reviewed the submittal. The meeting is to be conducted prior to finalizing the functional test procedures and shall be attended by the CxA, EMCS contractor, the VRFZ Control System contractor/supplier, mechanical engineer and a representative of the Owner's maintenance group at a minimum. The CIM shall include, but not be limited to, the following topics:

1. Sequence of Operations
2. Alarm Points List
3. Trend Points List
4. Displayed/Adjustable Point List
5. Graphical Interface
6. Integration with packaged equipment
7. Integration between control systems
8. Point-to-Point Checkout

Prior to any functional testing, a complete and documented start-up process shall have occurred. This includes point-to-point verification, sensor calibration and operational mode verification.

Prior to any graphical system development, the control contractor is to submit a System Setup Outline to the Commissioning Authority and Owner/Owner's representative for approval. The outline should describe the graphics to be provided along with a detailed list of the individual points to be displayed, screen linking, security levels, alarm management, schedules, trending, animation strategies, navigation, etc.

Trend logs shall be entered per the direction of the CxA to support demonstration of operation as outlined below for the performance period.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

The CxA shall develop a series of functional performance tests to be conducted by the contractor and as outlined below. Part 4 of this specification section includes sample functional test documents. These are samples only and do not reflect all functional test requirements. The contractor shall conduct the functional tests and turn over the completed functional test documentation and trend logs to the CxA. The CxA shall re-conduct a portion of the tests. The

contractor shall include time in their bid to support the CxA during this activity. This support does not include the normal point-to-point and operational verifications that should take place during start-up.

The EMCS and VRFZ control contractors shall make available to the CxA, at no additional cost, a method of interfacing with the control system at the building site. This interface shall be made available regardless of if a permanent local work station is specified in the contract documents or not. The interface shall be made available for the duration of the commissioning process and all commissioned systems are accepted. The EMCS and VRFZ control contractors shall also make available to the CxA, at no additional cost, a method of remotely accessing the system during the commissioning process and up to one year after system acceptance. Remote and local access shall include all software, licensing, software keys and anything else required to facilitate full access to the system. The local and remote interfaces shall include all contract required interfaces including, but not limited to, all graphics, trends and alarms. The CxA shall be given an account with full security access privileges to the system.

The contractor shall review the test plan provided by the CxA to verify the following:

1. The functional tests will not endanger the equipment or personnel in the facility.
2. The functional tests can be performed per the plan with the installed interface and equipment.

Functional Tests:

1) Functional testing to demonstrate proper operation of ALL modes of operation of all systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following equipment:

    a) VRFZ Fan Coil Units

2) Functional testing to demonstrate proper operation of ALL modes of operation of all systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following modes:

    a) Unoccupied mode
    b) Unoccupied limits
    c) Occupant override mode
    d) Optimal Start
        i) Heating mode
        ii) Cooling mode
    e) Warm-up mode
    f) Occupied mode
        i) Heating mode
        ii) Cooling mode
        iii) Energy recover mode – including economizer

3) Functional testing to demonstrate operation of all sub-systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following categories:

    a) Fan control

b) Interlocked fan operation
c) Zone temperature control
d) Thermostatic control
e) Automatic damper control and modulation
f) Heating/cooling capacity
g) Alarm monitoring
h) Graphical user interface

4) System stability and control verification via trending (performance period). Trend logs to be set up by control contractor to demonstrate system performance, to include, but not limited to the following performance variables. Trend logs shall be set up for all inputs/outputs, both digital and analog, for all points in the system both physical and virtual. Trend interval shall be 5 minutes unless otherwise directed by the CxA. The minimum trend period shall be 14 days. Trend log point headings as displayed on system graphs and data tables shall be adequately descriptive for the point but no longer than 12 characters unless approved by the CxA. System default names are not acceptable. The heading titles shall contain no extraneous characters that are not needed to describe the point. The contractor shall provide the trends to the Commissioning Authority in electronic format, in MS Excel or a comma delimited file.

a) Zone temperature control
b) Morning warm-up verification
c) Optimum start-stop verification
d) Water and electrical usage

5) Functional testing of all equipment protections monitored by the automatic temperature control system, safeties and alarms including but not limited to the following modes:

a) Smoked detector, fire alarm shutdown for air handling equipment
b) VRFZ parameter failures
c) Dirty filter status
d) Fan failure and alarms
e) Phase loss protection

PART 4 – SAMPLE FUNCTIONAL TEST DOCUMENTS

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that shall be required from the contractor. These forms and procedures shall be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that shall be required to be executed by the contractor.

Automatic Temperature Control Functional Test Samples
FCU or AHU w/ Heating, Cooling & Economizer

Unoccupied Mode

1. Place the control system in the unoccupied mode by changing the schedule.
2. Verify that all controlled points listed are off, OSA dampers are closed.
3. Verify by direct observation that all controlled points are off and dampers are in the correct position.

AHU:					
Supply/Return fan command displayed OFF					
Supply/Return fan status displayed OFF					
Supply/Return fan, observed OFF					
Heating command displayed					
Cooling command displayed					
OSA damper position displayed CLOSED					
OSA damper position, observed CLOSED					
Return air damper position displayed OPEN					
Return air damper position, Observed OPEN					
Relief damper position displayed CLOSED					
Relief damper position, observed CLOSED					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Unoccupied Limits

1. Place the system in the unoccupied mode and verify all AHUs are off and heating, economizer and cooling are not locked out.
2. Simulate a zone temperature below the unoccupied low limit.
3. Verify unit comes on in full recirculation and heating system modulates to control zone temperature.
4. Verify unit stops when zone is satisfied.
5. Simulate a zone temperature above the unoccupied high limit
6. Verify unit comes on in cooling and the system modulates to control zone temperature.
7. Verify unit stops when zone is satisfied.
8.

Unoccupied Limits

AHU:					
Pre-Test:					
Unoccupied low limit					
Unoccupied high limit					
Zone temperature					
Test:					
Unoccupied low limit changed to:					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

Unoccupied High Limit

Unoccupied high limit changed to:					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

☐ Set points returned to original values.

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Unoccupied Occupant Override – AHU

1. Place the system in the unoccupied mode and verify all AHUs are off.
2. Set the override period to a minimum value.
3. Simulate a call for heating or cooling as required, test a minimum of two each for heating and cooling.
4. One at a time, press the override button for each space.
5. Verify the AHU goes into the occupied mode and system is in heating or cooling.
6. Verify unit stops at end of time period.

AHU:					
Pre-Test:					
Override run time					
Zone temperature					
Zone set point					
Test:					
Override run time adjusted to					
Zone temperature set point adjusted to					
Heat Test or Cool Test					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off at end of override					

☐ Set points returned to original values.
☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Occupied Mode Tests

1. Place the system in the occupied mode by changing the schedule.
2. Verify by direct observation that the supply fan starts, the air dampers modulate to normal position (minimum air or higher), heating and cooling is set to control to current set point, relief dampers open and other parameters are normal.
3. Verify BAS displays the correct status for the units.

AHU:					
Space temperature					
Space temperature set point					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Zone Control - Cooling

1. Verify outside air is below economizer lockout temperature.
2. Lower the zone set point slightly below the current zone temperature.
3. Verify outside air dampers open for economizer cooling and DX cooling remains off.
4. With an increased call for cooling, verify DX cooling is activated.
5. Mixed Air Low Limit: Simulate a mixed air temperature below the mixed air low limit set point and verify mixed air low limit overrides the economizer control by closing the outside air damper. Release low limit when done.
6. Economizer Lockout1: Simulate an OSA temperature above the return air temperature and verify OSA dampers modulate to minimum position. Release when done.
7. Economizer Lockout2: Simulate an OSA temperature above the Economizer Lockout Set point and verify OSA dampers modulate to minimum position.
8. Raise set point to eliminate a call for cooling.
9. Cooling with economizer lockout: With economizer locked out. Create a demand for cooler air. Verify cooling is activated immediately.

Cooling Control:

AHU:					
Pre-Test:					
Zone temperature					
Zone set point					
Outside air temperature					
Economizer minimum set point					
Economizer lockout set point					
Economizer damper position					
OAT					
RAT					
MAT					
DAT					
Mixed air low limit set point					
Test:					
Zone set point lowered to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature after 3 minutes					
Economizer is first stage of cooling					
Zone set point lowered to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
Discharge air temperature after stabilization					
Mechanical cooling coil is second stage of cooling					

Limits

AHU:					
Mixed Air Low Limit					
Mixed air low limit set point changed to					
Outside air dampers close to control to MLL					
Economizer Lockout					
Dampers to minimum position on economizer lockout based on return air					
Dampers to minimum position on economizer lockout based on outside air					
Cooling control during economizer lockout:					
Zone set point lowered to					
Cooling command displayed					
OSA damper position displayed					
Supply air temperature after stabilization.					
RAT					
MAT					
Mechanical cooling is first stage of cooling					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Zone Control - Heating

While system is still in cooling, simulate a zone temperature below the zone temperature set point.
Verify economizer is at minimum.
Verify discharge air temperature set point is reset higher in response to heating demand.
Verify heating operates to control to set point.

Heating Control:

AHU:					
Pre-Test:					
Economizer minimum set point					
Zone temperature					
Zone set point					
Test:					
Set point raised to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature after 3 minutes					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Thermostat Calibration and Point to Point Test.

1. At each thermostat location, press override push button (or raise/lower setpoint).
2. Verify that BAS indicates correct zone in override.
3. Measure room air temperature and record actual and BAS indicated temperatures.

Unit No.	Override	Room Temp	BAS Temp	Unit No.	Override	Room Temp	BAS Temp

☐ Set points returned to original values.

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
CxA:			

Comments:

AHU Hard Wire Shutdowns:

1. Mixed Air Low Temperature: Trip freeze stat and verify fan shuts down and dampers close.

AHU:					
Shutdown on freeze					
Reset OK					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Installing Contractor:			
CxA:			

Comments:

Exhaust Fans

BAS Controlled Exhaust Fan Test (with Fan Proof)

1. Place the control system in the unoccupied mode.
2. Verify all exhaust fans under BAS control are commanded off, display an off status and are off by physical inspection (PI).
3. Place the system in the occupied mode.
4. Verify all exhaust fans under BAS control are commanded on, display an on status and are on by physical inspection (PI).
5. Turn off the exhaust fan at the disconnect and verify fan failure alarm is generated.
6. Turn power to fan back on and verify alarm clears.

EF-	1	2	3	4	5
Unoccupied Mode:					
Exhaust fan command displayed OFF					
Exhaust fan status displayed OFF					
Exhaust fan, PI OFF					
Occupied Mode:					
Exhaust fan command displayed ON					
Exhaust fan status displayed ON					
Exhaust fan, PI ON					
Exhaust fan failure alarm received					
Exhaust fan failure alarm cleared					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
CxA:			

END OF SECTION 230800

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Control Damper Installation.

1.3 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Submit product data for all items to be used.

1.4 GENERAL REQUIREMENTS

A. General: The control system is specified in Division 25. The Division 23 contractor is required to coordinate the work with the control systems work to allow installation of items required for the HVAC control system, and to install the control items indicated.

B. Control Dampers: Furnished under Division 25 and installed under this specification section.

1.5 REFERENCES

A. ASTM B88: Standard Specification for Seamless Copper Water Tube.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install items in accordance with manufacturer's instructions and control system requirements. Coordinate all work requirements with Division 25.

B. Control Dampers: Install all control dampers furnished by Division 25 and as necessary for proper functioning HVAC systems. Verify damper sizes, locations, orientation, accessibility, and other installation requirements.

END OF SECTION 230900

SECTION 232000 - STEAM AND CONDENSATE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Steam and Condensate Piping.

B. Valves.

C. Traps.

D. Specialties.

1.4 SUBMITTALS

A. General: All submittals shall comply with Section 200500.

B. Product Data: Submit manufacturer's product data for all products to be used.

1.5 REFERENCES

A. ASME B1.20.1. Pipe Threads, General Purpose (Inch).

B. ASME B16.3: Malleable Iron Threaded Fittings.

C. ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.

D. ASME B16.4: Gray Iron Threaded Fittings.

E. ASME B31.1: Power Piping.

F. ASME B31.9: Building Services Piping.

G. ASTM A105: Carbon Steel Forgings for Piping Applications.

H. ASTM A106: Seamless Carbon Steel Pipe for High-Temperature Service.

I. ASTM A193: Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

J. ASTM A53: Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.

K. ASTM A530: General Requirements for Specialized Carbon and Alloy Steel Pipe.

L. AWS D1.1: Structural Welding Code.

M. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.

N. ASTM F104: Standard Classification System for Nonmetallic Gasket Materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Pipe and Fittings: Domestic Manufacturers only.

C. Valves: Crane, Stockham, Grinnell, Nibco, Milwaukee, Spirax Sarco, Watts, Hammond.

D. Traps and Specialties: Spirax Sarco, Watts, Armstrong, Penn.

E. Pressure Reducing Valves: Spence, Armsrong, Watts, Cash Acme.

F. Safety Relief Valves: Watts, Conbraco/Apollo, Consolidated.

G. Condensate Receiver and Boiler Feed-water Systems: Skidmore, Industrial Steam, Precision, Bell & Gossett.

2.2 PIPE FITTINGS – MATERIALS

A. Pipe: Black steel pipe, per ASTM A53, Type E or S, Grade A or B; or per ASTM A106, Grade B; unless indicated otherwise. Schedule 40 unless indicated otherwise.

B. Fittings:

1. Threaded: Malleable iron fittings per ASME B16.3 or threaded cast iron fittings per ASME B16.1 or ASME B16.4.
2. Welded: Steel weld fittings per ASTM A234; butt weld type per ASME B16.9; socket weld type per ASME B16.11.
3. Flanged: Fittings, bolts, nuts, and bolt patterns per ASME B16.5, Class as indicated. Flanges shall comply with ASTM A105. Bolts shall be high strength or intermediate strength, with material conforming to ASTM A 193. Gaskets shall be per ASTM F104, coated on both sides with lubricant.

C. Threads: Shall conform to ASME B1.20.1

2.3 PIPE AND FITTINGS – APPLICATIONS

A. Steam: Schedule 80 steel pipe conforming to ASTM A 106, Grade B, with Class 300 welded or threaded fittings on pipe 2 inch and smaller, and Class 300 flanged or welded fittings on larger pipe sizes.

B. Condensate: Schedule 80 steel with Class 150 threaded fittings on piping 2 inch and smaller; and Class 150 flanged or welded fittings on larger pipe sizes.

C. Drains, Vents: Schedule 80 steel with 2000 psi wog welded fittings on piping 2 inch and smaller; and Class 300 flanged or welded fittings on larger pipe sizes.

2.4 VALVES

A. Ball Valves: Rated for 250 psi steam, two piece bronze body, full port, anti-blowout stem, carbon filled TFE seats, stainless steel vented ball, stainless steel handle and nut with plastic or vinyl coating on handle, threaded end connections. Provide with extension stem for handle where valve is installed in systems with insulation thickness greater than standard valve size will accommodate. Nibco T-585-70-66-ST (or approved).

B. Check Valves:

1. 2 Inches and Smaller: Stockham B-375; Milwaukee Valve 507; Nibco T-473B.
2. 2-1/2 Inches and Larger: Stockham 30-SF-SW.

2.5 TRAPS

A. Float and Thermostatic Traps (F&T): Shall be rated at a steam working pressure of approximately 15 psig, but shall operate with a supply pressure of approximately 5 psig. The capacity of the traps shall be as indicated or, where not indicated, three (3) times BTU/hr. capacity of equipment connected; use 0.001 Lb./BTU times capacity for lb./hr. sizing. Trap capacity shall be based on a pressure differential of 5 psig. Each float-and-thermostatic trap shall be provided with a hard-bronze, monel, or stainless steel valve seat and mechanism and brass float, all of which can be removed easily for inspection or replacement without disturbing the piping connections. Inlet to each trap shall have a strainer, either an integral part of the trap or a separate item of equipment. Sizes shown on the drawings are lbs-hr continuous capacity based on 1 psi differential, per Steam Heating Equipment Manufacturer's Association Standards, not manufacturer's instantaneous ratings.

2.6 SPECIALTIES

A. Vacuum Breaker: Vacuum Breaker: Stainless steel body with stainless steel valve, and shall be suitable for operating conditions of 210 psig, and 500 degrees F. Spirax-Sarco VB14.

B. Steam Gun: Getinge Group Model No. 7510 steam gun assembly. (Addendum 3)

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of all items shall comply with code, best professional practices, and manufacturers written installation instructions.

B. Provide all piping as indicated and as required to allow complete steam and condensate connections to each item requiring steam or forming condensate.

C. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

D. Provide piping connections to equipment furnished by others in accordance with Section 200500.

3.2 PIPE AND FITTINGS

A. All piping in finished areas shall be installed concealed unless specifically noted otherwise.

B. Install piping at such heights and in such a manner so as not to obstruct any portion of windows doorways, passageways, or access to any items requiring routine service, maintenance, or inspection. Offset or reroute piping as required to clear any interferences which may occur.

C. Consult all drawings for location or pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

D. Allow sufficient clearances for installation of pipe insulation in thickness specified. If interferences occur, reroute piping to accommodate insulation.

E. Coordinate installation of items with all trades that are affected by the work to avoid conflicts.

F. Pipe Pitch: Install steam piping pitched down toward steam or condensate returns with a slope not less than 1 inch in 10 feet.

G. Provide escutcheons where exposed pipe passes through walls, floors, or ceilings.

H. Install all piping parallel to the closest wall and in a neat, workmanlike manner. Horizontal exposed straight runs of piping shall not deviate from straight by more than 1/4-inch in ten feet. Vertical piping shall not deviate from plumb by more than 1/8-inch in ten feet.

I. Do not run any piping above electrical panels (and similar electrical equipment). Provide offsets around such panels as necessary. Such offsets are typically not shown on the plans, and are required per this paragraph.

J. Prior to the joining of any section of pipe to a pipe run, the section shall be thoroughly cleaned inside and out, the ends shall be reamed to remove any cutting burrs and piping prepared as recommended by pipe and fitting manufacturer.

K. Threaded Connections: Cut piping carefully, ream, thread and work into place without springing. Use TFE tape or lead and graphite lubricant (on male threads only).

L. Welding: Shall conform to ASME B 31.1 and ASME B 31.9. Welders and welding operators shall be qualified as required by ASME B 31.1, ASME B 31.9, and governing code. Welded joints on piping system shall be continuous, without backing rings, and pipe ends beveled for butt weld connections. Gas cuts shall be square and free from burned material. Before welding, surfaces shall be thoroughly cleaned. Piping shall be carefully aligned, with no weld material projecting inside the pipe.

M. Insulating Unions/Flanges: Install dielectric insulating unions or insulating type flanges between all connections of dissimilar metals.

N. Changes in Direction: Shall be made with fittings, except that bending of pipe up to 4 inches will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center line radius of bends shall not be less than six diameters of the pipe. Changes in direction of piping shall be made with welding fittings; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME. Weld defects shall be removed and repairs made to the weld, or the weld shall be entirely removed and re-welded at no additional cost to the Owner. Electrodes shall be stored and dried in accordance with AWS D1.1 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

O. Flanged Joints: Flanged joints shall be faced true, provided with gaskets, and made square and tight. Full-faced gaskets shall be used with cast iron flanges, and all gaskets shall be as thin as the finish of the flange face permits.

3.3 VALVES

A. General: Provide valves as shown on the drawings.

B. Installation: Install valves so as to be easily accessible and oriented to permit ease of operation. Valve stem shall be directed in the vertical direction. Provide access doors for valves not otherwise accessible.

3.4 TRAPS, SPECIALTIES AND EQUIPMENT

A. Connections to Equipment: Flanged joints or unions shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, equipment, control valves, and similar items.

B. Provide connections to all equipment and as required for properly functioning systems.

C. Pressure Gauges: Provide pressure gauges upstream and downstream of pressure reducing valves and where indicated. Provide a shut-off cock and siphon for all gauges.

D. Trap Connections: Provide isolation valve and strainer immediately upstream of all traps, and check valve and isolation valve immediately downstream of all traps. Provide traps at condensate outlets on all steam equipment, on steam lines, at all low points, and elsewhere as required to collect condensate. Provide test valve downstream of trap.

E. Vacuum Breaker: Install where shown on drawings. Install in vertical position, per manufacturer’s instructions. Provide with isolation valve to allow service.

3.5 FLUSHING AND TESTING

A. Scope: All steam and condensate piping systems that have been worked on shall be flushed and tested. The system shall have an initial test applied after flushing and an additional final test.

B. Isolation: Isolate from the piping any parts of the system or equipment that may be damaged by the test pressure or entrapment of debris during the flushing process. The system may be isolated into various smaller sub-systems to allow easier testing and locating of leaks. Provide temporary bypass piping as required.

C. Flushing: Prior to initial testing and chemical cleaning, the system shall be filled and flushed with clean water to remove all large debris. Flush system until water runs clear.

D. Initial Testing: After initial flushing and draining, the system shall be refilled and an hydrostatic test applied. Test pressure shall be 100 psig. System shall hold the test pressure for a minimum of 2 hours with no drop in pressure. Any leaks shall be repaired and the system re-tested until system proves tight.

E. Final Testing: After successful initial testing, the system shall be prepared for normal operation, with equipment connected (except parts of system or equipment that would be damaged by the final test pressure) and re-tested using the same pressures and criteria as outlined for the Initial Testing. All leaks shall be repaired and the system re-tested until it proves tight.

F. Gauges: Contractor shall insure that clear, accurate, and readable pressure gauges are used to insure accurate testing and allow for witnessing by others. Contractor shall make a written record of the gauge readings, time, date, and where connected to the system and mark this information on the as-builts.

G. Witnessing: Contractor shall notify the Architect/Engineer in advance (minimum three (3) days notice) of when testing will take place. Such testing may be witnessed at the option of the Architect/Engineer.

3.6 COMMISSIONING

A. The equipment and systems referred to in various mechanical sections are to be commissioned per Section 230800 – Commissioning of HVAC. The Contractor has specific responsibilities for scheduling, coordination, startup, test development, testing, and documentation. Coordinate all commissioning activities with the Commissioning Consultant.

END OF SECTION 232000

SECTION 233100 - HVAC DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Environmental Ductwork Systems.

B. Flexible Duct.

C. Acoustical Duct Lining.

D. Preparation of Duct for Service.

E. Duct Pressure Testing.

1.3 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

B. Environmental Ductwork Systems: Ductwork systems that are not covered by Section 233500 - Special Exhaust Systems.

1.4 QUALITY ASSURANCE

A. All work and materials shall comply with SMACNA-DCS, NAIMA-DLS, ASHRAE-F, IBC, IMC, NFPA-90A, NFPA-90B, and code. The most restrictive criteria governs.

B. Leakage Criteria: Duct system shall be constructed and sealed so that leakage does not exceed 5%.

C. Fabrication Proximity: The Contractor performing the work of this section shall have fabricating facilities located within 100 miles of the project site.

D. Drawing Review: Prior to beginning any work review all drawings, duct routing, duct connections, equipment configuration, equipment connection locations, and other work details to discover conflicts in anticipated duct arrangement and improper or incomplete connections. Review shall include the following: supply ducts not connected into return (or exhaust) ducts, ducts not crossed and improperly connected in shafts, air outlets/inlets connected to ducts, unit configuration compatible with planned duct connections, louver locations match architectural plans. Submit resolutions of such possible conflicts as submittals with shop drawings of proposed solutions; written description in lieu of shop drawings is acceptable for minor issues.

1.5 SUBMITTALS

A. General: Comply with Section 200500.

B. Submit shop drawings showing proposed resolution of conflicts after review of documents and again after review of actual field conditions.

1.6 DUCT PRESSURE CLASS

A. Constant Volume Systems: Ductwork shall be constructed to the pressure class corresponding to 1.2 times the static pressure indicated for the fan which serves the duct system (plus or minus as appropriate); unless noted otherwise. (For example, a fan designed to operate at 1-inch wc static pressure would require 2-inch pressure class duct construction as 1-inch x 1.2 = 1.2-inch; 2-inch is therefore the required pressure class.)

1.7 REFERENCES

A. ADC-FLEX: Air Diffusion Council Flexible Duct Performance and Installation Standards.

B. ASHRAE-F: ASHRAE Handbook of Fundamentals.

C. ASTM A 653: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

D. ASTM A 924: General Requirements for Steel Sheet Metallic-Coated by the Hot-Dip Process.

E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

F. IMC: International Mechanical Code.

G. NAIMA-DLS: North American Insulation Manufacturers Association Fibrous Duct Liner Standards, 1st Edition.

H. NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems.

I. NFPA 90B: Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

J. SMACNA-DCS: SMACNA HVAC Duct Construction Standards.

K. UL 181: Underwriter Laboratories Factory-Made Air Ducts and Air Connectors.

L. UL 181A: Underwriter Laboratories Closure Systems for Use with Rigid Air Ducts.

M. UL 181B: Underwriter Laboratories Closure Systems for Use with Flexible Air Ducts and Air Connectors.

1.8 PRE-INSTALLATION CONFERENCE

A. General: A pre-installation conference shall be held prior to the Contractor installing any of the materials of this section. The conference shall occur after all submittals have been satisfactorily reviewed by the Architect/Engineer and returned to the Contractor, and approximately 14 days prior to the proposed system installation date and prior to the fabrication of any system piping components. The purpose of this conference is to review the Contractors installation methods, materials, schedule, coordination with all other trades, and related construction/design issues to allow for efficient and proper construction. The Architect/Engineer and Owner will highlight various items of concern, typical problems encountered on similar projects, coordination issues, and related items.

B. Attendance: The pre-installation conference shall be attended by the General Contractor, the Contractor doing the work of this Section, other contractor trades as appropriate to the proper coordination of the work of this section, the Owner's Representatives (at their option), the Engineer, and the Architect.

C. Coordination: The Contractor shall notify the Architect of the Contractor's readiness to hold the pre-installation conference at least 14 days prior to the proposed meeting time, and mutually agreed upon meeting times arranged.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Sheet Metal: All domestic manufacturers.

C. Spin-in Fittings and ATTO: Sheet Metal Connectors Inc., United McGill, Royal Metal Products, Airflow Products Inc.

D. Gasketing: Preson, Insulfab, Duraco.

E. Duct Sealant and Tape: Carlisle (Hardcast), Ductmate, Benjamin Foster, Grace Construction Products, United McGill, Polymer Adhesives Sealant Systems, RCD Corporation, Nashua, 3M.

F. Flexible Duct: Flexible Technology Inc., JP Lamborn Co.; Hart & Cooley, Thermaflex.

G. Acoustical Duct Lining: Johns-Manville.

2.2 GENERAL MATERIALS

A. Ducts: Construct of galvanized sheet steel, suitable for lock forming without flaking or cracking, conforming to ASTM A653 and A924, having a zinc coating of 0.90 ounces total per square foot for both sides of a sheet, corresponding to coating G90.

B. Fasteners: Steel construction, electroplated zinc coated, having strength properties adequate for the application, compatible with materials being joined, and in accordance with SMACNA-DCS. Where exposed to corrosive conditions shall be of Type 304 or 316 stainless steel. Type to meet duct pressure class and duct leakage requirements. Where used for the support and anchorage of ducts shall comply with Section 200529, with

independent test reports regarding strength.

C. Spin-in Fittings: Factory fabricated of galvanized steel with die-formed mounting groove and damper with raised damper quadrant where ducts are to be insulated. Collar length for flexible duct attachment shall be at least 2" long.

D. Air-Tight Take-Off Fittings (ATTO): Factory fabricated of galvanized steel. Flange shall be 1-1/2" wide with 1/8" self-adhesive gasket and pre-drilled fastener holes. Collar length for flexible duct attachment shall be at least 2" long. Where used on round duct mains, shall be saddle type appropriately sized for main duct diameter.

E. Draw Bands:

1. Metal: Worm gear type clamp, constructed of galvanized steel, stainless steel, or aluminum; minimum 1/2-inch wide band; suitable for 200 pound loading.
2. Non-Metal: Nylon "zip-tie" with self-locking ability, designed for flexible duct usage, minimum 1/4-inch wide, rated for 175 pound load, suitable for temperatures from 0 to 185 deg F; listed per UL181B and labeled "UL181B-C".

F. Gasketing: Vinyl nitrile, vinyl neoprene, or neoprene nitrile PVC blend; designed for HVAC use with size to suit the application having minimum 1.5-inch width at equipment roof curb applications. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development per ASTM E 84.

G. Duct Sealant/Mastic: Water based duct sealant, listed per UL 181B-M and UL 181A-M, suitable for indoor and outdoor use. Fire resistant with a flame spread rating of 5 or less, and a smoke developed rating of 0. Sealant shall be resistant to ultraviolet radiation and ozone. Fiberglass mesh shall be minimum 0.006-inches thick, with minimum 9 x 9 weaves per inch, and 2-inch width; for use with mastic in sealing ductwork. Sealant system shall be suitable for duct system pressure class and materials used with. Carlisle Hardcast "Versa-Grip 181".

H. Foil Tape: Foil back adhesive tape, listed per UL181A-P and UL181B-FX, with listing labeled on tape outer foil face. Minimum 3-inch width for metal-to-metal applications; minimum 2-inch width for flexible duct applications. 3M No. 3340 or Nashua No. 324A.

2.3 DUCT FABRICATION

A. Duct Gauge and Reinforcement: Shall be as shown in SMACNA-DCS according to the pressure classification of the system and the duct dimensions; with heavier gauge duct used as required to minimize duct reinforcement to suit space available and other project constraints.

B. Joints and Seams: Construct in accordance with SMACNA -DCS, code requirements, and these specifications (more stringent governs). Ducts shall be constructed and sealed so that the leakage criteria is not exceeded. Round ducts shall be the spiral seam type; except that branch ducts to individual air inlets/outlets less than 16" diameter may be of other types as allowed by SMACNA-DCS. Coordinate joint spacing with duct reinforcement requirements so that transverse joints having the required stiffness may be incorporated in the reinforcement spacing schedule. Round duct transverse joints shall be made with beaded sleeve joints or flanged connections in accordance with SMACNA-

DCS; except that branch ducts to individual air inlets/outlets less than 16" diameter may use other joining methods as allowed by SMACNA-DCS.

C. Elbows and Tees: Shall be long-radius type with a center-line radius not less than 1-1/2 times the width or diameter of the duct. Where space does not permit the use of long-radius elbows, short-radius or square elbows with turning vanes may be used. Elbows in round duct systems with duct pressure class above 2-inches shall be stamped type, welded segmented type, or standing seam segmented type.

D. Transitions: Increase duct sizes gradually. Transitions for diverging air flow shall be made with each side pitched out not more than 22.5 degrees. Transitions for converging air flow shall be made with each side pitched in not more than 30 degrees. Except that eccentric transitions for round to flat oval may have up to a 45 degree pitch.

E. Branch Connections: Shall comply with SMACNA-DCS, and as required herein.

1. Rectangular-to-Rectangular: Rectangular take-off with 45 degree angle on “inside” of take-off, minimum 4" length. Reference SMANCA-DCS Figure 4-6. Close corner openings.
2. Rectangular-to-Round:

    a. Serving Individual Air Inlet/Outlet: Spin-in type connector or air-tight take-off (unless a different fitting type is specifically noted).
    b. Serving Branch Duct: Rectangular to round transition, with maximum degree pitch as specified for transitions. Rectangular end size shall have free area no less than round end. Rectangular connection to rectangular main shall be made as specified for “Rectangular-to-Rectangular” connections.
    c. Serving Individual VAV Terminal Unit: Conical type connector, with connector 2" larger on one end and maximum 15 degree pitch on sides.

3. Round-to-Round:

    a. Serving Individual VAV Terminal Unit: Conical type connector (or conical tee fitting), with connection at the main duct 2" larger than the end serving the VAV terminal unit, and a maximum 15 degree pitch on sides; or “Lo-Loss” tee fitting, equivalent to that manufactured by United McGill.
    b. Other Connections: Air-tight take-off or constructed in accordance with SMACNA-DCS and recognized professional practices.

4. Other Connections: In accordance with SMACNA-DCS and recognized professional practices.

F. Ductmate Systems:

1. Rectangular Duct: Transverse duct joints may be made with Ductmate System, or approved equal. System shall consist of companion flanges of 20 gauge galvanized steel with an integral polymer mastic seal; corner pieces of 12 gauge G90 galvanized steel; 20 gauge G90 galvanized cleats; closed cell, high density gasket type; and galvanized carriage bolts with hex nuts. The flanges shall be

securely fastened to the duct walls using self-drilling screws, rivets or spot welding. Fastener spacing shall be as recommended by the manufacturer for the size of duct and the pressure class. The raw duct ends shall be properly seated in the integral mastic seal. A continuous strip of gasket tape, size 1/4" x 3/4", shall be installed between the mating flanges of the companion angles at each transverse joint; and the joint shall be made up using 3/8-inch diameter x 1-inch long plated bolts and nuts. Galvanized drive-on or snap-on cleats shall be used at spacing recommended by the manufacturer.

2. Round Duct: Transverse duct joints may be made with Ductmate “Spiralmate” system, or approved equal. System shall consist of galvanized steel round connector flanges (fitting inside each duct section to be joined) and an exterior galvanized steel closure ring with tightening bolt to form an airtight duct connection and join flanges together. Duct connector flanges shall have non-hardening integral mastic to seal between flanges and duct, and a neoprene gasket to seal flange faces.

G. Lined Ductwork:

1. Rectangular Ducts: Contractor Fabricated ductwork with interior duct lining. Duct fabrication and liner installation shall comply with NAIMA-DLS. Lining material shall comply with paragraph titled “Duct Lining” in this specification section.
2. Round and Oval Ducts: Shall consist of acoustic insulation in between a perforated interior duct liner and solid exterior duct. Acoustic insulation shall be 1-inch thick, except where noted to be greater. Duct sections shall connect by mechanical means to maintain positive concentricity of liner with duct. All fittings and transitions shall have perforated inner liner (except where noted otherwise). Lining material shall comply with paragraph titled “Duct Lining” in this specification section. United McGill "Acousti-k27" (or approved).

2.4 FLEXIBLE DUCT

A. Type: Factory insulated fully lined flexible duct.

B. Construction: Double-ply neoprene coated polyester fabric hose, reinforced with a steel wire helix. Black color. Fire hazard rating not to exceed 25 for flame spread and 50 for smoke development, as tested by ASTM E84.

C. Thermal Characteristics: Certified Thermal resistance “R” of 4.2 Hr-SF-deg F/Btu in accordance with ADC-FLEX.

D. Working Pressure: As required to suit maximum pressure to be encountered on system, but no less than 4-inch wc positive, 0.5-inch wc negative.

E. Length: Shall not exceed 8 feet where used on duct systems with a pressure class of 2-inches and less; maximum 5 feet length on higher pressure class systems.

F. Code Compliance: Shall comply with all applicable codes, NFPA 90A, NFPA 90B, and shall be UL listed and labeled as a Class 1 connector per UL 181.

2.5 ELASTOMERIC DUCT LINING

A. Material: Flexible, expanded closed-cell, anti-microbial elastomeric material; black in color; with maximum thermal conductivity of 0.25 Btu-inch/hr-sq. ft.-degree F at 75 degree F. Suitable for air temperature of 180 degrees F. Armacell "Armaflex Duct Liner" (or approved).

B. Thickness: Lining shall be 1-inch thick except where noted otherwise.

C. Adhesives: Factory applied self-adhesive backing.

D. Fungi and Bacteria Resistance: Conform to ASTM G21 for fungi resistance and ASTM G 22 for bacteria resistance.

E. Odors: No noticeable odor emissions per ASTM C665.

PART 3 - EXECUTION

3.1 DUCTWORK INSTALLATION

A. General: Install all ductwork with all accessories and connections to provide complete and operable duct systems, in accordance with plans and specifications. See Section 200529 for hangers and supports. Provide quality assurance review of all drawings prior to beginning work (see paragraph titled Quality Assurance, this specification Section and see Section 200500). Provide duct and plenum sizes and locations as shown on the drawings; except as adjusted for field conditions and work of other trades, and with prior approval of the Engineer. See Section 200500 for offsets and transitions to be included in project.

B. Coordination: The Contractor shall fully coordinate the work of all trades to avoid interferences and conflicts. Due to the extremely tight spaces in portions of the building, the Contractor shall coordinate duct reinforcement spacing and supports with other trades as necessary to avoid interferences. In addition, the Contractor shall select duct gauge and reinforcement types to avoid interferences. Changes required due to lack of coordination between trades, improper spacing or selection of hangers, or improper duct gauge and reinforcement selection, shall be done at no additional cost to the owner.

C. Field Measurements: Prior to fabricating any duct materials, the Contractor shall field measure all areas where ducts will be installed to verify room available and all offsets and fittings required. Field verify connection sizes and locations to equipment, louvers, and similar items.

D. Workmanship: All work shall comply with code, SMACNA-DCS, and other applicable standards. Ducts shall be installed level (unless noted otherwise) and in neat lines with the building construction using best professional practices.

E. Exposed Ducts: All ducts are to be installed concealed unless indicated otherwise. Ducts that are exposed shall be carefully fabricated, stored, and installed for best appearance. All dents, dings, scratches and other damage shall be repaired for a high quality finished look; all dirt, debris, labels, stickers, lettering, and marks removed; and the duct completely cleaned. Any sealant shall be cleaned to form a straight and even seam

adjacent to joints, have no overlap onto duct areas not needing sealant, and have all excess sealant removed (mask off adjacent areas as necessary).

F. Flexible Duct: May only be used where specifically shown on the plans. Attach flexible duct inner core to sheet metal duct (or connector) with draw band. For insulated type, pull insulation and outer jacket completely over the inner core (at the connection to the sheet metal duct) with outer jacket covering the inner core and tucked back at its end to provide a continuous vapor barrier cover; install draw band to secure the outer jacket and insulation. Use metal type draw bands on duct systems where duct pressure class exceeds 3-inches or where temperature or other conditions do not allow the non-metal type and where indicated; use type of metal suitable for the conditions without corrosion or other deterioration. Install flexible duct with a centerline turning radius not less than one duct diameter. Where this turning radius cannot be maintained with the flexible duct use sheet metal elbows or (at air inlets/outlets) provide a plenum having a side connection.

G. Spin-in Fittings/ATTO's: May be used for branch ducts to individual outlets only. Apply a bead of duct sealant to all spin-in fittings where fitting seals against sheet metal duct.

H. Sealing:

1. General: Use materials listed and approved for the specific application. Foil tape may only be used at duct connections to air inlets/outlets (unless specifically noted otherwise). Clean surfaces to be sealed of moisture and all contaminants. Seal joints in accordance with SMACNA-DCS, sealant manufacturer's instructions, and UL 181.
2. Ductwork: Seal to meet duct leakage criteria as follows:

    a. Ducts upstream of VAV terminal units: Seal Class A.
    b. Ducts downstream of VAV terminal units: Seal Class C.
    c. Ducts with pressure Class 3" and greater: Seal Class A.
    d. Ducts with pressure Class 2": Seal Class B.
    e. Ducts with pressure Class 1" and less: Seal Class C.

3. Flexible Duct: Coat connection of flexible duct to metal duct with duct sealant prior to installing the flexible duct.
4. Air Inlets/Outlets: Seal duct connections (including "cans" or plenums) at air inlets and air outlets with duct sealant or foil tape; except at louvers and exposed ducts only sealant shall be used.

I. Ductmate: All "Ductmate" and similar systems shall be installed in strict accordance with manufacturer's instructions.

J. Protective Caps: Provide temporary sheetmetal caps or heavy visqueen covers over all open portions of ductwork to prevent debris, dirt, and dust from entering the ductwork. Such covers shall be installed at the end of each work shift, and shall remain in place until all work activities or events that may cause duct contamination will no longer occur.

3.2 ACOUSTICAL DUCT LINING INSTALLATION

A. General: Install acoustical duct lining in ducts to extent shown on drawings, covering all interior surfaces. Round ducts shall use factory fabricated double-wall ducts as specified.

B. Installation: Installation shall comply with NAIMA-DLS and these specifications. The liner shall be cut to assure tightly butted joints.

C. Liner Attachments: The duct liner shall be applied with a 100% coverage of adhesive. Mechanical Fasteners shall be installed flush with the liner surface, and shall be spaced in accordance NAIMA-DLS.

D. Horizontal Duct Runs: Tops of ducts over 12" wide and sides of duct over 16" high shall have liner additionally secured with mechanical fasteners.

E. Vertical Duct Runs: Any side of duct over 12" in size shall have liner additionally secured with mechanical fasteners.

F. Exposed Edges: All joints, exposed edges and any damaged areas of the liner, shall be heavily coated with fire resistant adhesive/mastic.

G. Metal Nosing: Install metal nosings on the leading edges of the liner in ducts where the velocity exceeds 4000 feet per minute.

3.3 PREPARATION FOR SERVICE

A. Cleaning: All ducts shall be wiped or blown clean of all dust and debris prior to the installation of grilles or diffusers. Notify the Engineer to allow for an inspection prior to installing grilles or diffusers.

B. Contaminated Ducts: Where ducts have been contaminated by dirt or debris during the construction process, the affected duct systems shall be cleaned by an independent firm specializing in the vacuum cleaning of ductwork. All costs associated with such cleaning shall be the responsibility of the Contractor.

3.4 DUCT PRESSURE TESTING

A. Tested Systems: All supply air duct systems shall be tested.

B. Duct Pressure Class > 2-inches:

1. Cap all outlets temporarily to isolate the portion of the system being tested.
2. Use portable blower with volume adjustment and a calibrated orifice for determining cfm of air being added to ductwork. Maintain duct system rated pressure in duct; examine each section at this pressure, and seal all observable leaks so that leakage during final testing will be at or below maximum permissible leakage.
3. Maximum Permissible Leakage: See “Quality Assurance” paragraph, Part 1 of this specification section.
4. Final test of each section shall be witnessed by the Architect/Engineer or Owner's representative. Give Architect/Engineer at least 7 days prior notice before such test.
5. Test Data: Record data of test results of final test only, including sketch or diagram of tested section, computation of total system cfm, allowable leakage and actual leakage found during test. Submit two copies to Architect/Engineer.

C. Duct Pressure Class ≤ 2-inches: Air balancers readings will be used to determine percent leakage of ductwork. Where leakage exceeds allowable by 25% or less, sealing shall be provided at all potential leak spots. Where leakage exceeds allowable by more than 25%, the system shall be re-sealed and the Sheetmetal Contractor shall pay the Balancer to re-measure and determine the new leakage rate.

3.5 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 233100

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Manual Dampers.

B. Combination Fire/Smoke Dampers.

C. Backdraft Dampers.

D. Turning Vanes.

E. Flexible Connectors.

F. Duct Access Doors.

G. Air Measuring Units.

H. Sound Attenuation Materials.

1.3 QUALITY ASSURANCE

A. General: Comply with Section 200500.

B. Workmanship: Construction and installation of all duct accessories shall comply with applicable SMACNA-DCS, and exceed those standards as noted.

C. Fire dampers, combination fire/smoke dampers, and smoke dampers shall be UL listed.

1.4 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data: Submit product information on all items to be used.

C. Sound Attenuators: Submit dynamic insertion loss and pressure drop data for all sound attenuators. Submit listing of all sound attenuators by unit served, airflow application, cfm, size, velocity, and pressure drop.

1.5 REFERENCES

A. AMCA 500D: Laboratory Methods for Testing Dampers for Rating.

B. SMACNA-DCS: SMACNA HVAC Duct Construction Standards, 3rd Edition.

C. UL 555S: Smoke Dampers.

D. UL 555: Fire Dampers.

E. UL 555C: Ceiling Dampers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Manual Damper Hardware: Duro-Dyne, Young Regulator Co., Ventfabrics, Krueger.

C. Fire Dampers, Combination Fire/Smoke Dampers and Smoke Dampers: Ruskin, National Controlled Air, Air Balance, Greenheck.

D. Backdraft Dampers: Air Balance, Ruskin, Greenheck.

E. Turning Vanes: Duro-Dyne, Aero-Dyne, Oil Capital Sheet Metal, Airsan.

F. Flexible Connections: Ventfabrics, Duro-Dyne Elgen.

G. Duct Access Doors: National Controlled Air, Ventfabrics, United-McGill, Kees, Ruskin, Vent Products.

H. Air Measuring Units: Cambridge Filter Corp., Monitor Corp.

I. Building Access Doors: See Section 083113.

2.2 MANUAL DAMPERS

A. Type: Manually adjustable volume dampers.

B. Blades: Damper blades shall be fabricated of galvanized steel or stainless steel (unless a specific material is indicated), two gages heavier than duct in which installed, and in accordance with SMACNA-DCS. Maximum blade width 12 inches; fabricate multi-blade dampers with opposed blade pattern for ducts larger than 12" x 48".

C. Regulators: Damper regulator sets shall have quadrant dial regulator with locking nut, square end bearing one side, and spring round end bearing other side (small sizes) or open end square bearing (larger sizes), axis of blade the long dimension. Multiple blade dampers shall have individual quadrants for each blade or one quadrant with interconnected blades. Regulator sets shall be Duro-Dyne model numbers (or approved equal) as follows:

Max. Blade Dimension	Duro-Dyne Regulator Set	Shaft Size
10" and less	KS-145, 145L	1/4"
11" to 14"	KSR-195, 195L	3/8"

15" to 23"	SRS-388, SB-138, KP105	3/8"
24" and larger	SRS-128, SB-112, KP105	1/2"

D. Concealed Regulator: For remote damper adjustment with finished ceiling appearance. Shall consist of self-locking regulator of cast alloy construction (with serrated core, spring washer, housing, indicator, lock nut) cast into a cylindrical housing for flush ceiling installation. Housing cover shall be of steel construction, shall telescope into the regulator housing to be flush with the finished ceiling, and be secured to the housing with two screws. Provide with extension rods, linkages, miter gears, and all accessories as needed for proper damper operation. Plain Finish. Ventfabrics No. 666, 667 or Young Regulator Co. No. 301 (or approved equal).

E. Extractor Fittings: Galvanized steel construction, 24 gauge steel blades on 2 inch centers, with worm gear operator for adjustment through face of grille. Krueger EX-88 (or approved equal).

2.3 COMBINATION FIRE/SMOKE DAMPERS

A. Type: Combination fire smoke dampers, UL labeled, conforming to UL 555, UL 555S, NFPA 90A, NFPA 92A, NFPA 92B.

B. Leakage Rating: Class I. Dampers shall be classified as Leakage Rated Dampers for use in Smoke Control Systems per UL 555S.

C. Fire Resistance: Dampers shall have a 1-1/2 hour fire rating (unless a longer rating is indicated or required by code).

D. Elevated Operational Temperature: Assembly shall be qualified by UL 555S to operate at 350 degrees F.

E. Construction: Frame shall be of minimum 5" x 1" 16 gauge galvanized steel channel, with 4” to 7” wide blades constructed of 16 gauge galvanized steel. Blade edge seals shall be silicone type; jamb seals shall be stainless steel compression type. Axles shall be 1/2" plated steel hex, with stainless steel bearings pressed into frame. Provide with factory steel sleeve or steel frame, arranged for installation such that disruption of the attaching ductwork will not impair damper operation.

F. Configuration: Actuator exterior of damper sleeve assembly, except where damper occurs immediately behind an air inlet/outlet, and where the actuator would not otherwise be accessible, configuration shall allow through grille (or through duct access door) access to damper and actuator. Damper assembly shall be complete with sleeve length, sleeve gauge, retaining plates/angles, duct connection transitions, actuators, and accessories to suit the application and conform to damper UL listing and code.

G. Operation: Dampers shall be automatic operating and shall be spring operated to close when released by resettable link or by loss of power to actuator. Closure shall be controlled type to prevent duct damage from instantaneous closure. Momentary contact test switch shall allow for testing of damper closure.

H. Resettable Link: Electric, manually resettable type with bimetal heat responsive device to activate damper at set temperature. Set to operate for 50 degrees above maximum

temperature expected in duct but in no case less than 165 degrees F. Provide with momentary contact reset switch, factory wired to actuator, in accessible location at damper.

I. Test Switch: Momentary contact test switch, in accessible location at damper, to allow test of damper closure by pressing switch, factory wired to actuator, in accessible location at damper.

J. Actuator: Shall be for use with 120 volt 60 Hz AC power, two position spring return type to close damper upon loss of power (except where indicated to be a different arrangement or are part of an engineered smoke control system requiring modulating operation). Actuators shall be rated for continuous energized hold open position. Actuator shall be in a NEMA rated enclosure suitable for the conditions the actuator will be exposed to.

K. Operational Rating: Damper shall be rated for use with the maximum velocities and pressure differentials to which they will be exposed; but no less than 2000 fpm and 4 in w.g. differential pressure.

L. Open/Closed Indicator: Provide with a switch package to allow remote indication when the damper blades are full open and when damper blades are full closed. Switches shall be physically linked to damper blade to indicate actual blade position.

2.4 BACKDRAFT DAMPERS

A. Type: Airflow and gravity operated backdraft dampers. Greenheck WD-100, WD-300, WD-400 (or approved equal).

B. Frame: Shall be constructed of minimum 18 gauge galvanized steel or stainless steel or minimum 0.063 thick 6063T5 extruded aluminum (unless a specific material is indicated).

C. Blades: Shall be constructed of minimum 0.025" thick formed aluminum, or stainless steel (unless a specific material is indicated), with extruded vinyl edge seals. Seals shall prevent any noise due to damper opening/closing. Bearings shall be synthetic polycarbonate or acetal type. Damper linkage shall be with aluminum or galvanized steel tiebar. Dampers with vertical airflow shall be spring assist type.

D. Configuration: For horizontal or vertical airflow as indicated on plans.

E. Performance: Dampers shall be tested in accordance with AMCA standards. Pressure drop for 36" x 36" damper with vertical airflow at 250 fpm shall not exceed 0.05". Pressure drop for 36" x 36" damper with horizontal airflow at 250 fpm shall not exceed 0.07". Blades shall begin to open at 0.015-in w.g. pressure differential. Dampers used to prevent the entry of outdoor air shall have air leakage no greater than 20 cfm/sf at 1-in w.g. where not less than 24-inches in any dimension, and no greater than 40 cfm/sf where less than 24 inches in any dimension;, when tested in accordance with AMCA 500D.

F. Pressure and Velocity Ratings: Shall suit maximum velocity and pressure differential to which dampers will be subjected; but no less than 2500 fpm and 1.0-in w.g. differential pressure.

2.5 COUNTERBALANCED BACKDRAFT DAMPERS - LOW PRESSURE DROP

A. Type: Airflow and gravity operated backdraft dampers with adjustable counterbalance weight. Ruskin CBD6.

B. Frame: Shall be constructed of minimum 18 gauge galvanized steel or stainless steel or minimum 0.125-inch thick 6063T5 extruded aluminum (unless a specific material is indicated).

C. Blades: Shall be constructed of minimum 0.07-inch thick extruded aluminum, or formed stainless steel (unless a specific material is indicated), with extruded vinyl edge seals. Seals shall prevent any noise due to damper opening/closing. Bearings shall be synthetic polycarbonate or acetal or zytel type. Damper linkage shall be with aluminum or galvanized steel tiebar. Counterbalance weights shall be attached to blades, be of galvanized steel construction, and be adjustable.

D. Configuration: Horizontal or vertical airflow as indicated on plans.

E. Performance:

1. General: Dampers shall be tested in accordance with AMCA standards.
2. Temperature Rating: -40 to 200 degrees F.
3. Closed Position: Withstand maximum back pressure of 16 inches w.g.
4. Open Position: Withstand maximum air velocity of 2,500 feet per minute.
5. Operation of Blades: Start to open at 0.02 inch w.g.; fully open at 0.05 inch w.g.
6. Pressure Drop: Maximum 0.025 inch w.g. at 700 feeet per minute, maximum 0.15 inch w.g. at 1,500 feet per minute.
7. Dampers used to prevent the entry of outdoor air shall have air leakage no greater than 20 cfm/sf at 1-in w.g. where not less than 24-inches in any dimension, and no greater than 40 cfm/sf where less than 24 inches in any dimension; as tested in accordance with AMCA 500D.

F. Depth of Operation: Depth required to operate shall not exceed 10-inches.

2.6 TURNING VANES

A. Type: Galvanized steel turning vanes to guide airflow through duct elbows to minimize pressure drop.

B. Construction: Turning vanes shall comply with SMACNA-DCS. Vanes shall be fabricated of minimum 26 gauge galvanized steel; rails shall be fabricated of minimum 24 gauge galvanized steel. For duct widths less than 12 inches, vanes may be single wall construction; for widths 12” and greater, vanes shall be double wall "airfoil" type.

C. Spacing: Turning vanes shall be equally spaced in accordance with SMACNA-DCS, parallel to each other, and securely attached to runners.

D. Unequal Elbows: For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

2.7 FLEXIBLE CONNECTORS

A. Type: Flexible fabric type connectors, to provide vibration isolation at equipment duct connections and to allow for movement in duct systems.

B. Flexible Fabric:

1. General: Flexible glass fiber fabric with an inorganic elastomeric coating.
2. Width: Minimum 3" wide except at equipment 3 hp or larger with external vibration isolators fabric shall be minimum 6" wide.
3. Indoor Applications: Neoprene type, black color, minimum 22 oz/sq. yard, 500 lbs x 500 lbs tensile strength.
4. Outdoor Applications: Durolon type, while color ozone resistant, 24 oz/sq. yard, 250 lbs x 275 lbs tensile strength.

C. Metal Collars: Minimum 24 gauge galvanized steel 3" wide metal edge connectors, each side of fabric, connected to fabric by folded over metal seam.

D. Temperature Rating: Shall be suitable for temperatures from -40 to 200 deg F.

E. Fire/Smoke Rating: Material shall have a flame spread rating of not over 25, and a smoke developed rating of not higher than 50, and comply with requirements of IMC and NFPA 90A.

2.8 DUCT ACCESS DOORS

A. Construction: Access doors shall be of double wall construction, made with minimum 24 gage galvanized steel, tight fitting, with sealing gasket, and cam locks (or may be hinged type with latches).

B. Size:

1. General: Access doors shall be of sufficient size so that items concealed in duct can be serviced and inspected, and shall be adequately sized to allow complete removal of the item being served (where removal cannot be made without disturbing fixed ductwork).
2. Minimum size: Doors shall be minimum 14" x 14". Where duct size will not accommodate this size door, the doors shall be made as large as practicable.
3. Large Sizes: Doors larger than 14" x 14" shall have a minimum of 4 cam locks (or where hinged type is used, have a minimum of two (2) latches).

C. Insulation: Doors in insulated ducts shall be insulated type, with minimum 1 inch thick fiberglass insulation.

D. Round Ducts: Access doors on round ducts shall use either lined rectangular tap off with rectangular access door or curved insulated access door (for insulated duct); or curved type un-insulated access door (for un-insulated duct).

2.9 BUILDING ACCESS DOORS

A. See Section 083113 for building access door requirements. Minimum size shall be 12" x

12" (unless indicated otherwise) but shall be large enough to allow necessary access to item being served and sized to allow removal of the item (where access door is the only means of removal without disturbing fixed construction).

2.10 AIR MEASURING UNITS

A. Type: Multiple pitot tube type for measuring velocity pressure and corresponding airflow.

B. Construction: Units shall have 16 gauge (minimum) galvanized steel casing; copper or aluminum pressure sensing tubing; and 4 inches minimum depth aluminum air-straightening grid.

C. Airflow Sensing: Air flow sensing shall be by pitot tube; maximum of 144 square inches per static pressure sensor; maximum of 36 square inches per total air pressure sensor; sensors shall measure equal areas; sensors in circular ducts shall measure equal annular areas; sensors shall be interconnected to give average reading; output shall be suitable for control purposes as required.

D. Air Flow Meters: Diaphragm actuated differential pressure gauge, mounted on metal panel, calibrated to read cfm and fpm. Gauge shall be labeled indicating the fan or system being measured, and the design cfm.

E. Free Area: Units shall have free area at least 97% of connecting duct size area.

2.11 DUCT SMOKE DETECTORS

A. Supplied by Division 26.

PART 3 - EXECUTION

3.1 MANUAL DAMPERS

A. General: Dampers shall be fabricated and installed in accordance with SMACNA-DCS requirements for volume dampers.

B. Locations: Install dampers at locations shown on the drawings in branch ducts to all air inlets/outlets, and at all other locations as required by the Balancer to allow for the balancing of the system. Locate dampers at a point where the damper is most accessible; orient damper regulator for best access.

C. Non Accessible Dampers: Provide flush-mounted concealed type damper quadrants for ducts concealed in walls or non-removable ceilings and where a remote damper operator has been indicated.

D. Initial Setting: Set and lock all dampers in the full open position prior to balancing.

E. Extractor Fittings: Provide where indicated on the plans and at wall type inlets/outlets where such outlets cannot be served by a manual damper in the branch duct.

F. Identification: Provide orange surveyor’s tape, approximately 18” long tied to each damper regulator (except not required on dampers in ducts exposed to view in finished

areas).

3.2 FIRE DAMPERS, COMBINATION FIRE/SMOKE DAMPERS, SMOKE DAMPERS

A. General: Install dampers with all necessary retaining angles, sleeves, breakaway connections and other materials as required to provide an installation equivalent to that utilized by the manufacturers when dampers were tested at UL and as required by code.

B. Sleeves: Dampers shall be installed in a sleeve or casing which shall extend through the building element that the damper is installed in. Sleeve shall connect to duct in accordance with manufacturers approved installation requirements and code.

C. Sleeve Anchoring: Sleeve shall be anchored to wall or slab with minimum 1-1/2" x 1-1/2" x 14 gage angles on all four sides; angles shall be bolted, tack welded, or screwed to sleeve; angles shall overlap wall a minimum of one inch on all four sides.

D. Damper Anchoring: Damper shall be bolted, tack welded or screwed to sleeve on all four sides.

E. Wiring: Wiring to damper actuator shall be the responsibility of Division 26, unless indicated otherwise.

F. Access Doors: Provide access doors to all dampers, locate on corridor or mechanical room side where possible. Label doors with pre-printed label "FIRE DAMPER ACCESS", (or “FIRE/SMOKE DAMPER ACCESS”, “SMOKE DAMPER ACCESS”) minimum 1" high letters, color in sharp contrast to background.

G. Combination Fire/Smoke Damper Testing: Test operation of all fire/smoke and smoke dampers. Dampers shall operate (close) upon a smoke detector alarm (or building fire alarm system alarm), unit shall restore to its normal position upon restoration of the alarm to normal. The Contractor installing the dampers shall verify proper operation of each damper with the Division 16 Contractor present and submit signed documentation showing each individual damper has been satisfactorily tested.

H. Switch Package: Coordinate with Division 25 contractor for connection of switch package to building control system. Provide written statement signed by installing Division 23 Contractor stating that all dampers have been visually and operationally tested and they work properly.

3.3 BACKDRAFT DAMPERS

A. General: Install in accordance with manufacturer's instructions.

B. Application: Use counterbalanced type at all non-fan powered building exhausts and reliefs; all others shall be the standard type.

C. Adjustments: Adjust counterbalanced backdraft dampers to be open at 0.07” building pressure (unless noted otherwise), or as necessary for proper space pressurization and building air balance. Coordinate work and settings with air balancer.

D. Access Doors: Provide access doors to backdraft dampers, except that where damper is

installed immediately behind a ceiling or wall grille, and is accessible by removing this grille, an access door is not required.

3.4 TURNING VANES

A. General: Install turning vanes in all duct elbows and "T" fittings, and at locations shown on the drawings.

B. Attachment: Securely attach turning vane runners to ductwork.

3.5 FLEXIBLE CONNECTORS

A. General: Provide flexible connectors at all duct connections to all equipment, where ducts of dissimilar metals are connected, and where shown on the drawings. Except that flexible connectors are not required on internally spring isolated fans where the fan is located in a separate mechanical room and a flexible connector has not been shown.

B. Round: For round ducts, the flexible material may be secured by zinc-coated, iron clinch type draw bands directly to adjoining duct; or with normal duct joining methods and using metal collars furnished with flexible connectors.

C. Slack: Install flexible connections with sufficient slack to permit 1 inch of horizontal or vertical movement of ducts or equipment at flexible connection point without stretching the flexible material. At building expansion joints install sufficient flexible material to allow for 2 inch movement in any direction; provide two flexible connectors separated by a 12 inch section of duct.

3.6 DUCT ACCESS DOORS

A. General: Provide duct access doors at all automatic control dampers, fire dampers, fire/smoke dampers, smoke dampers, backdraft dampers, all duct coils, thermostats, filters, control devices, and any other components in the duct system that require service or inspection. Coordinate with Division 25 Control Contractor to confirm quantity and location of control devices.

B. Return and Exhaust Ducts: Provide access doors every 20 feet in return and exhaust air ductwork as required by NFPA 90.

C. Size and Location: Access doors shall be of sufficient size and so located so that the concealed items may be serviced and inspected or completely removed and replaced.

3.7 BUILDING ACCESS DOORS

A. General: Provide access doors in walls, floors, ceilings, etc. as indicated on the drawings and where needed to provide service access or maintenance to duct access doors, backdraft dampers, damper actuators, automatic dampers, coils, control devices, fans, HVAC equipment and similar items. Access doors are typically not shown in the plans. Review ceiling and wall types and locations of items requiring access to determine quantity and sizes of access doors required.

B. Coordination: Consult architectural drawings and coordinate location and installation of

access doors with trades which are affected by the installation.

3.8 DUCT SMOKE DETECTORS

A. Division 23 Contractor shall install the portions of duct smoke detectors that are installed in the ductwork. Installation shall comply with manufacturer's instructions; coordinate work and location with Division 26.

3.9 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 233300

SECTION 233400 - FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Ceiling Exhaust Fans.

B. Rooftop Low Profile Fans.

C. Rooftop Upblast Fans.

D. Rooftop Kitchen Upblast Fans.

E. In-Line Exhaust Fans.

F. Large Paddle Fans.

G. Fan Accessories.

1.3 SUBMITTALS

A General: Comply with Section 200500.

B. Product Data: Submit manufacturer's product data for all items to be used. Submit fan curves showing SP vs. CFM and BHP vs. CFM with system operating point clearly marked.

C. Sound Power: Submit sound power level data showing sound power levels in decibels referenced to 10 watts for each of the eight octave bands (not required for fans under 2000 CFM). Submit sound power levels in sones for fans under 2000 CFM (or decibel values if available).

1.4 QUALITY ASSURANCE

A. AMCA: Fans shall bear the AMCA certified seal unless indicated otherwise.

1.5 GENERAL REQUIREMENTS

A. Spare Parts: Provide two complete sets of spare belts for all belt driven fans.

1.6 REFERENCES

A. AMCA 210: Laboratory Methods of Testing Fans for Ratings.

B. IMC: International Mechanical Code.

C. NFPA 96: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

D. UL 762: Power Ventilators for Restaurant Exhaust Appliances.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 200500. See Section 200500, paragraph 2.1 for Acceptable Manufacturer requirements.

B. Exhaust Fans: Greenheck, Penn Barry, Cook, Carnes.

C. Large Paddle Fans: Big Ass or approved equal.

D. Air Doors: Greenheck or approved equal.

E. Accessories: Fan manufacturers listed, NCA, Ruskin, Thybar, RPS.

2.2 GENERAL

A. Guards: All belt drives shall be equipped with belt guards, or enclosed within fan casing. Guards shall be factory fabricated and furnished with equipment, and comply with OSHA and WISHA regulations. Exposed openings into fan housings shall be protected with substantial metal screens or gratings.

B. Drives: Shall be sized for not less than 150% of the rated motor horsepower.

C. Adjustable Sheaves: All belt drive fans shall have adjustable sheaves and adjustable supports for adjusting belt tension. Sheaves shall be selected so that they are at their midpoint at design conditions.

D. Motors:

1. General: Comply with Section 200500. Motors on belt drive fans shall have adjustable supports for adjusting belt tension. Motor speed controllers shall be VFD type except where solid state speed controllers are provided or EC motors with integral speed controller. VFD's shall be as specified in Division 25.
2. Fractional Horsepower Motors: Shall be the electronically commuted (EC) type with speed control where noted and where non-EC motors are not available which comply with code motor efficiency requirements. Unless noted otherwise, provide with manual speed control mounted at the motor for air balancers use. Motors shall be specifically designed for fan applications, have permanently lubricated ball bearings, speed controllable down to 20%, and have internal thermal overload protection.
3. Belt Drive Fans: Motors shall have adjustable supports for adjusting belt tension.

E. Performance: Fan capacity shall not be less than the values listed on the drawings. Fan performance shall be based on laboratory tests conducted in accordance with AMCA 210.

F. Outlets and Inlets: Fans shall be furnished with attachment angles and/or flanges as required for attaching ductwork and/or flexible connections indicated.

G. Fan Types: The type of each fan is indicated on the Fan Schedule, under the "Type" column, and corresponds to the types specified herein.

H. Fan Arrangement and Drive: Shall be as indicated. Select motor and drive access side to allow best access and to suit available space.

I. Electrical: Fan disconnects and motor starters shall comply with Division 26 specifications. Disconnects furnished with fan shall come factory wired to motor or shall be field wired by Division 23.

J. Finish: All fans shall have factory applied enamel finish (manufacturer's standard color, unless noted otherwise) over a rust inhibiting primer base coat; except a painted finish is not required on rooftop type fans of aluminum or equivalent corrosion resistant construction.

K. Backdraft Dampers:

1. General: Provide all exhaust fans with backdraft dampers. Backdraft dampers are not required for kitchen grease hood exhaust fans. Backdraft damper material shall match material of the duct in which it is installed.
2. Ceiling Exhaust Fans: Manufacturer’s standard backdraft damper, factory installed integral with the fan, to close automatically to prevent airflow in the opposite direction than intended when fan is off; or type as specified for “Other Fans” below.
3. Rooftop Fans: Multi-blade backdraft damper, to close automatically to prevent airflow in the opposite direction than intended when fan is off, aluminum or galvanized steel construction (except shall be of stainless steel construction where duct system served is constructed of stainless steel). Frame shall be minimum 0.090-inches thick, with minimum 0.050-inch thick blades, synthetic bearings, concealed linkage connecting all blades, vinyl or felt blade edge seals, rated for 2500 feet per minute velocity, counterbalanced with adjustable weights to allow for proper operation. Leakage less than 10 cfm at 0.5-inch w.g. pressure differential for a 36-inch square damper. Install in roof curb at fan.

L. Weatherproof: Where installed exposed to weather, fans shall have weatherproof enclosure, preventing any wind driven water entry into unit or drive assembly.

2.3 CEILING EXHAUST FAN

A. Type: Centrifugal exhaust fan with integral grille. Greenheck Model SP or approved.

B. Housing: Shall be constructed of galvanized steel, with discharge backdraft damper, and 1/2" - 1-1/2 lb/cubic foot density fiberglass duct liner insulation. Fan shall have either top or horizontal discharge (as required). Housing shall have adjustable mounting brackets to match ceiling thickness.

C. Grille: Shall be of aluminum or steel construction, with white baked-on enamel finish; except that fans with scheduled capacity less than 250 cfm capacity may have grilles constructed of high impact polystyrene.

D. Fan Wheel: Shall be forward curved, centrifugal type.

E. Drive: Fan shall be direct drive, with motor mounted on resilient elastic supports.

F. Accessories: Provide, the following accessories where indicated on the Fan Schedule or shown on the drawings:

1. Speed Control: Speed controller allowing speed reduction down to 50% of maximum.
2. Disconnect: Factory mounted on side of cabinet or within unit but so as to be accessible when unit is installed.

2.4 ROOF TOP LOW PROFILE FANS

A. Type: Low profile centrifugal fan for roof top curb mounting, with backward inclined fan wheel and louvered penthouse hood. Greenheck Model LDP and LBP, or approved.

B. Housing: Shall consist of louvered penthouse type hood constructed of minimum 0.040-inch thick aluminum with mitered and welded corners. Hood shall have aluminum hinged removable cover, allowing access to complete drive assembly and wheel. Curb cap shall be of aluminum construction, with pre-punched mounting holes (minimum two each side). Lower windband shall be of aluminum construction and shall be welded to curb cap and support unit drive assembly. Inlet cone shall have deep venturi shape and match fan wheel inlet. Provide with birdscreen on outlet. All fasteners shall be corrosion resistant type. Conduit chase shall be provided through the curb cap for routing electrical conduit/wiring into the power compartment.

C. Fan Wheel: Shall be aluminum, backward inclined, non-overloading centrifugal type; dynamically and statically balanced. Wheel shall overlap inlet venturi to allow maximum performance.

D. Drive Assembly: Entire drive assembly shall be mounted on rubber vibration isolators. Belt driven units shall have motor and drive located out of the airstream. Drive assembly support frame shall be constructed of heavy gauge steel or aluminum. Drive shafts shall be constructed of ground and polished steel, with permanently lubricated sealed ball bearings. Fan shall be direct or belt drive as indicated on the Fan Schedule.

E. Motor: Shall be permanently lubricated, sealed ball bearing type. Shall comply with Section 200500.

F. Accessories: Provide the following accessories where indicated on the Fan Schedule or shown on the drawings.

1. Disconnect Switch: Factory mounted in motor compartment and wired to motor.
2. Speed Control: Solid state speed controller, allowing manual control of motor speed and reduction down to 50% of maximum. Where motor type is not

available for use with a solid state speed controller, provide with variable frequency drive.

3. Roof Curbs: For roof top curb mounting type fans. Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum of all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match fan and/or extended base used with. Provide with built-in cant and step height (to allow for roof insulation), as required to match roof type. Provide with damper type as shown.
4. Sound Attenuating Roof Curb: Same as specified for roof curb above but with acoustical baffles to attenuate noise. Acoustical baffles shall be constructed of perforated aluminum sheet formed into baffles and filled with fiberglass wool and held in place by steel spring wire clips. Greenheck Model A-T, or approved.

2.5 ROOF TOP UPBLAST FAN

A. Type: Centrifugal fan, for roof top mounting, with upblast discharge. Greenheck CUE (or approved).

B. Housing: Windband shall be constructed of minimum 16 gauge aluminum. Entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the housing. Provide birdscreen in fan discharge. Fan shall have heavy gauge steel curb cap and drain tube with external grease trough for collection of liquid residue.

C. Fan Wheels: Shall be aluminum, backward inclined, non-overloading centrifugal type; dynamically and statically balanced.

D. Drive: Entire drive assembly shall be mounted on rubber vibration isolators. Motor and drives shall be isolated from the exhaust airstream. Air for motor cooling shall be taken into motor compartments by means of an air tube from an area free of contaminated exhaust fumes.

E. Backdraft Damper: Provide with gravity operated backdraft damper.

F. Accessories:

1. Disconnect Switch: Provide external junction box with weatherproof disconnect, factory wired to motor.
2. Speed Controls: Speed controller, allowing speed reduction down to 50% of maximum. Controller shall be for mounting in a standard wall box. Where motor type is not available for use with a solid state speed controller, provide with variable frequency drive.
3. Roof Curbs: For roof top curb mounting type fans. Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum of all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match fan and/or extended base used with. Provide with built-in cant and step height (to allow for roof insulation), as required to match roof type. Provide with damper type as shown.

4. Sound Attenuating Roof Curb: Same as specified for roof curb above but with acoustical baffles to attenuate noise. Acoustical baffles shall be constructed of perforated aluminum sheet formed into baffles and filled with fiberglass wool and held in place by steel spring wire clips. Greenheck Model A-T, or approved.

2.6 KITCHEN UPBLAST FAN

A. Type: Centrifugal rooftop upblast vertical discharge fan, for commercial kitchen exhaust.

B. Housing: Windband shall be constructed of minimum 16 gauge aluminum. Entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the housing. Provide birdscreen in fan discharge. Fan shall have heavy gauge steel curb cap, and drain tube with external grease trough for collection of liquid residue.

C. Fan Wheels: Shall be aluminum, backward inclined, non-overloading centrifugal type; dynamically and statically balanced.

D. Drive: Entire drive assembly shall be mounted on rubber vibration isolators. Motor and drives shall be isolated from the exhaust airstream. Air for motor cooling shall be taken into motor compartments by means of an air tube from an area free of contaminated exhaust fumes.

E. Code Compliance: Fan shall be UL 762 listed for restaurant exhaust use and comply with IMC, NFPA 96, and code.

F. Hinge Kit: Fan base shall be hinged to allow lifting of fan for access to ductwork; provide with restraint cables to limit range of motion to approximately 90 degrees.

G. Accessories:

1. Disconnect Switch: Provide external junction box with disconnect, factory wired to motor.
2. Roof Curbs: For roof top curb mounting type fans. Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum of all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match fan and/or extended base used with. Provide with built-in cant and step height (to allow for roof insulation), as required to match roof type. Provide with damper type as shown.

2.7 IN-LINE FANS

A. Type: Square housed, in-line centrifugal fan. Greenheck SQ, BSQ (or approved).

B. Housing: Shall be constructed of galvanized steel, minimum 20 gauge for fans with up to 14" diameter fan wheels, minimum 18 gauge 14" to 29" fan wheels, and minimum 16 gauge for 30" diameter fan wheels and larger. Housing shall be of square shape, with inlet and outlet square duct mounting collars. Housing shall have removable or hingeable access covers providing complete access to fan internals. Housing shall be lined with minimum 1" thick 1-1/2 lb per cubic foot fiberglass duct liner.

C. Fan Wheel: Shall be aluminum, backward inclined, non-overloading, centrifugal type; dynamically and statically balanced.

D. Drive: Fan shall be direct or belt drive as indicated on the Fan Schedule.

1. Belt Drive: Fan bearing and drive components shall be isolated from the air stream. Motor shall be located outside the housing and cooled by ambient air. Provide motor position indicated on drawings. Wheel shaft shall be ground and polished and mounted in permanently lubricated, sealed ball bearing pillow blocks, with a minimum average bearing life over 200,000 hours. Provide with belt tensioner.
2. Direct Drive: Fan wheel shall be directly connected to motor.

E. Supports: Fans shall be provided with supports for horizontal base mounted, horizontal ceiling suspended, or vertical mounting as shown on the drawings. Provide spring type vibration isolators for horizontal suspended fans and neoprene type for base mounted units. Vibration isolators shall be sized to match fan weight.

F. Electrical Connections: Fans shall be factory wired to an external junction box and disconnect switch. Fan shall have flexible wiring for units where fan motor swings out of way for housing access.

G. Accessories: Provide the following accessories where indicated on the Fan Schedule.

1. Inlet Vane Dampers: Shall be constructed of minimum 20 gauge steel, factory mounted in fan inlet, to provide automatic variable air volume operation. (Actuator and control specified in Division 25).
2. Speed Controls: Solid state speed controller, allowing speed reduction down to 50% of maximum. Controller shall be for mounting in a standard wall box. Where motor type is not available for use with a solid state speed controller, provide with variable frequency drive.

2.8 LARGE PADDLE FANS (HVLS)

A. Type: Industrial quality large diameter high volume low speed (HVLS) paddle fan. Big Ass Fans “Isis” (or approved).

B. Blades and Hub: Eight blades constructed of extruded 6063 extruded aluminum alloy, heat treated for strength, with aerodynamic airfoil shape and end winglets to improve fan efficiency and effectiveness. Blades shall be connected to center hub by two locking bolts each blade, and an additional minimum 14 gauge galvanized steel safety strap. Hub shall be constructed of cast aluminum alloy.

C. Gear Reducer: Helical gear type, permanently lubricated, stainless steel shaft and hardened steel gears.

D. Motor and VFD: Electric motor coupled to gear reducer, inverter rated with class F insulation, thermally protected. Provide each fan with a VFD (variable frequency drive) sized to suit the fan used with, having ability integral with VFD’s for handling voltage irregularities. Shall be mounted at motor and be factory wired to motor; for use with remote on/off and speed control. Provide solid state overloads for each motor.

E. Mounting: Steel support assembly constructed of heavy gauge steel, for mounting of fan in configuration indicated on the plans. Main support tube shall be minimum 3 inch diameter, with length to suit required fan mounting height. Provide with minimum ¼-inch diameter galvanized steel cable and accessories to provide additional safety anchoring of fan to building structural member; cable shall be able to support fan shock load in case of main support failure. Provide with mounting yokes and accessories to suit roof pitch and allow fan to be installed level. Mounting shall be designed to withstand seismic forces for the applications and project location.

F. Finish: Blades shall have clear anodized aluminum finish, winglets shall be black. All other exterior visible parts of fan and all supports shall be finished with a powder coated paint finish, color as selected by Architect (from manufacturers standard colors).

G. Controls:

1. Local Control: Provide with ability for local manual on/off control and speed control. Controls shall control all fans in the same area in unison (unless noted otherwise).
2. EMCS: Provide interface with building EMCS to allow for remote enable/disable by EMCS, remote EMCS speed control, and for local Hand-off-Auto control. See Division 25.
3. Fire Alarm Interface: Provide with relay for wiring to building fire alarm system to stop fan operation when fire sprinkler flow occurs; relay shall be factory wired to fan controls.

H. Sound Performance: Unit sound pressure levels shall not exceed 35 dBA at high speed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with Section 200500. Install in accordance with manufacturer's written installation instructions, code, applicable standards and best construction practices.

B. Locations: Install fans at locations indicated and in accordance with the Contract Documents.

C. Speed Controls: Fans with solid state speed controllers shall have the speed controller mounted on the fan housing unless another location is indicated on the drawings (for use by Balancer). Install VFD's at accessible locations near item served.

D. Connections: Provide flexible connections in ductwork connections to all fans.

E. Rooftop Type Fans: Rooftop type fans shall be mounted on roof curbs, secured to curb on all sides, and sealed watertight.

F. Vibration Isolation: Install all fans with vibration isolators so that no sound or vibration is transmitted to the structure; except not required for rooftop type fans. See Section 200548 for vibration isolation specifications.

G. Sheaves: Provide sheave changes for all belt driven fans. Sheave changes shall meet Balancer and Engineer requirements.

H. Operation and Maintenance:

1. General: Operation and Maintenance shall be in accordance with manufacturer's written procedures and recognized best maintenance practices. Keep records of maintenance and (upon request) forward to the Architect/Engineer prior to project final acceptance.
2. Stored Products: Provide maintenance (i.e. equipment rotation, lubrication, cleaning, etc.) and inspection on products while stored to maintain new condition.
3. Installed Products: Provide maintenance and inspection of products and operate fan systems until substantial completion or specified Owner Instruction has been provided (whichever is later). Maintenance shall include all manufacturer's recommended maintenance (i.e. bearing lubrication, belt tensioning, etc.). In addition to scheduled maintenance, review all equipment periodically to allow detection of improper operation or any special maintenance needs; review shall be consistent with best practices for the product but in no case less than every two weeks.
4. Fans shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete. Fans shall not be placed into service until start-up has been completed.

I. Owner Instruction: Instruct Owner on the operation of each fan, including: system start-up, shut-down, emergency shut-down, normal control operation, safety aspects, maintenance and repair instructions.

J. Start-Up: Prior to start-up inspect fans and installation to confirm proper installation and system is ready for start-up. Arrange other trades to be present as needed (i.e. balancer, electrician, etc.). Check fans for correct rotation, tighten belts to proper tension, adjust fan speeds to provide required performance, verify proper electrical and control connections, check vibration isolation (as applicable) for correct operation, and lubricate bearings per manufacturer's recommendations.

3.2 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 233400

SECTION 233500 - SPECIAL EXHAUST SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Kitchen Hood Exhaust Ductwork.

B. Dishwasher Hood Ductwork.

C. Pharmacy Hood Exhaust Ductwork.

D. Dryer Vent.

1.3 QUALITY ASSURANCE

A. All hoods and ducts shall comply with NFPA, IMC and applicable ACGIH and SMACNA construction standards.

1.4 SUBMITTALS

A. General: All submittals shall comply with Section 200500.

B. Product Data: Submit manufacturer’s product data for all items to be used.

1.5 REFERENCES

A. ACGIH: American Conference of Governmental Industrial Hygienists, Industrial Ventilation - A Manual of Recommended Practice, 20th Edition.

B. NFPA 45: Fire Protection for Laboratories Using Chemicals.

C. NFPA 91: Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.

D. NFPA 96: Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment, 1986 Edition.

E. SMACNA: Round Industrial Duct Construction Standards, 1977 Edition.

F. SMACNA- DCS: HVAC Duct Construction Standards.

G. UL 2518A: Clothes Dryer Transition Duct.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

2.2 MISCELLANEOUS DUCTWORK

A. Ductwork: Where ductwork is used on any "miscellaneous" exhaust hoods", it shall comply with Section 233100 for the applicable pressure/velocity class.

B. Flexible Dryer Vent Duct:

1. Type: UL listed dryer transition duct.
2. Construction: Flexible aluminum, uninsulated, suitable for temperatures up to 400 deg F, with flame spread and smoke development ratings of 0 as tested by ASTM E84.
3. Listing: UL listed per Standard 2158A.
4. Connectors: Steel worm gear type clamps.

C. Rigid Dryer Vent Duct: Minimum 24 gauge stainless steel or aluminum; with no fasteners protruding into duct, rated for 1-inch wc pressure class (unless noted otherwise, complying with Section 233100.

2.3 KITCHEN HOOD AND DISHWASHER HOOD

A. Hoods: See Division 11.

B. Ductwork: Shall be constructed of minimum 16 gauge steel or stainless steel 0.044 inches thick with all seams and joints having a liquid-tight continuous exterior weld, and complying with IMC and NFPA standards. Pressure class shall be minus 3-inch w.g. (unless noted otherwise).

2.4 PHARMACY HOOD EXHAUST DUCTWORK

A. Ductwork: Shall be constructed of stainless steel of the following minimum gauges:

Diameter Inches	Duct Standard Gauge	U.S. Thickness Inches
Up to 7"	22	0.0313
8" to 11"	22	0.0313
12" To 15"	20	0.0375
16" To 19"	18	0.0500

B. Joints: All joints shall be welded. Cross joints shall be slip type with 1" inside lap in the direction of airflow.

C. Supports: Support duct runs on minimum 8 foot centers. Supports shall be band type as shown in SMACNA HVAC Duct Construction Standards. See Section 200529 for allowable hanger loads and types.

D. Fittings: Shall be constructed of material at least 2 gauges heavier than that required for

straight duct. Elbows shall have minimum centerline radius of two pipe diameters. Construct elbows 6" in diameter or less of at least five sections, elbows over 6" in diameter shall have seven sections. Transition shall be tapered to provide minimum 2" change in diameter in five inches of length. (11.3 Degrees). All branches shall enter the main at the large end of the transition of an angle not to exceed 45 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all exhaust systems as shown on the drawings and in compliance with governing codes.

B. All welded galvanized material shall have welds power-wire brush cleaned and shall be painted with cold galvanizing paint.

3.2 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 233500

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. GRD Outlets.

B. GRD Inlets.

C. Louvers.

D. Wall Caps.

E. Roof Hoods.

F. Roof Vents.

1.3 DEFINITIONS

A. GRD's: Grilles, Registers, and Diffusers.

1.4 REFERENCES

A. AHRI 885: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. AMCA 500: Laboratory Methods of Testing Louvers for Rating.

C. ASHRAE 70: Method of Testing the Performance of Air Outlets and Air Inlets.

D. ASHRAE-F: ASHRAE Handbook of Fundamentals.

E. SMACNA-DCS: HVAC Duct Construction Standards, 3rd Edition.

1.5 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Submit product information for all items to be used.

C. Operation and Maintenance: Submit operation and maintenance data and submittal data for inclusion in project O&M Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Grilles, Registers and Diffusers: Titus, MetalAire, Krueger, Price, Tuttle & Bailey, Kees, Carnes.

C. Louvers: See Division 10.

D. Wall and Roof Caps: Greenheck, PennBarry, Nutone, Carnes.

E. Dryer Vent Caps: Broan, Nutone, Greenheck, PennBarry, Cook, Carnes, Columbia.

F. Roof Hoods and Vents: PennBarry, Greenheck, Carnes, Cook “TRE” Series.

2.2 GENERAL REQUIREMENTS

A. Type: Air outlets and inlets shall be of the size, type, and with number of throws as shown on the drawings; and shall match the appearance and performance of the manufacturers' models specified and scheduled on the drawings.

B. Performance: Air outlet and outlet performance shall be based on tests conducted in accordance with ASHRAE 70.

C. Sound Level: Air outlets and inlets shall not exceed a sound level of NC 30 for the size indicated and airflow rate application. Sound levels shall be determined in accordance with AHRI 885 and ASHRAE-F.

D. Finish: Grilles, Registers and Diffusers shall have factory applied finish, color as selected by Architect/Engineer, except where indicated to have a brushed aluminum finish (or other finish type). Finish shall be an anodic acrylic paint, baked on, with a pencil hardness HB to H. Pint shall pass a 90 hour ASTM B117 salt spray test, 250 hour ASTM D870 water immersion test, and an ASTM D2794 reverse impact test with at least a 50 inch-pound force applied.

E. Frame Style: Provide air outlets and inlets with frame style to match ceiling or wall construction installed in. Where supply air outlets or inlets are installed in T-bar ceiling systems, they shall be factory installed in 2' x 2' or 2' x 4' metal panel to match ceiling layout. Where installed against gypsum board surface, brick or similar hard surface, or where exposed, provide with 1-1/4" wide outer border. Where space does not permit installing 2' x 2' metal panel, provide outlets or inlets with 1-1/4" wide outer border. Where air outlets are installed adjacent to surface mounted light fixtures, outlets shall have 4-inch deep drop frames. (See reflected ceiling plan and/or electrical lighting plan for ceiling and lighting types).

F. Transfer Grilles: Ceiling transfer grilles shall be same as ceiling exhaust grilles (CEG) unless noted otherwise; wall transfer grilles (WTG) shall be same as wall exhaust grilles (WEG) (unless noted otherwise). In secure areas transfer grilles shall be the secure type, same as CRG-S (unless noted otherwise).

G. Construction: Air outlets and inlets shall be of steel or aluminum construction except

that:

1. Where noted to be constructed of a specific material, shall be as noted.
2. In assemblies with a required fire rating and required to have fire dampers shall be of steel construction.
3. In wet areas or subject to condensation (i.e., locker rooms, restrooms, kitchens, exterior soffits, etc.), where not used in fire rated assemblies, shall be of aluminum construction.
4. Air outlets and inlets in the same room, area, or within common view shall be constructed of the same material.

H. Security Grille Fasteners: Where fasteners are required on security grilles they shall be the Torx type, with head center pin, minimum 1/4-inch diameter, and length to allow fastener anchoring to building structure. Where grilles are anchored by welding additional fasteners are not required.

2.3 SUPPLY AIR OUTLETS

A. Ceiling Diffuser (CD): Aluminum or steel construction, modular core, with multiple curved (or angled) discharge blades, and square neck. Cores shall consist of four separate sections which can be repositioned to allow for one, two, three or four way discharges. Cores shall be easily removed with no tools required. Krueger 1240 Series, Titus MCD, MCD-AA Series (or approved equal).

B. Ceiling Diffuser (CDL): Aluminum or steel construction, with curved backpan and formed edge of face panel designed for 360 deg airflow for low flow applications (50 cfm and less). Titus TJD (or approved equal). *Other acceptable manufacturers that do not manufacturer a similar 'low flow' product, may include this Titus grille as part of their submittal package.* (Addendum 2)

C. Ceiling Diffuser Register (CDR): Same as CD but with opposed blade damper.

D. Wall Supply Grille (WSG): Aluminum or steel construction, double deflection type, with horizontal face bars and vertical rear bars. Unit shall have outer frame borders 1-1/4" wide, with mitered corners, and perimeter gasket to prevent air leakage. Frame shall be constructed of minimum 22 gauge steel or minimum 0.032-inch thick aluminum. Deflecting bars shall be rigid extruded aluminum of semi-air-foil design, on 3/4" centers. Vertical and horizontal bars shall have friction pivots at each end to allow for blade angle adjustment without blade loosening or rattling. Krueger 5880H, 880H Series; Titus 300FL, 300FS Series (or approved equal).

E. Wall Supply Register (WSR): Same as WSG but with an opposed blade damper operable through the face of the grille.

F. Continuous Linear Slot Diffuser (CLSD): Constructed of extruded aluminum with fully adjustable air pattern and flow control vanes that shall be capable of deflecting the air pattern from horizontal along the ceiling to straight down or at an intermediate setting. Unit shall be so designed that when deflecting vanes are in the closed position, the air pressure tends to form a tight seal. Air flow rate shall be varied without changing the air pattern. The common set of vanes in diffuser that controls the air pattern and flow rate shall perform these functions satisfactorily without the use of an additional damper.

Krueger Series 1900.

G. Perforated Supply Diffuser (PSD): Perforated ceiling grilled used for supply, of aluminum construction, with 0.055-inch thick aluminum plate, having 3/16-inch diameter perforations on 1/4-inch staggered centers to provide no less than 51% free area.

2.4 RETURN AIR INLETS

A. Ceiling Return Grille (CRG): Aluminum construction, "cube-core" or "egg-crate" type, with 0.025-inch thick x 1/2-inch deep strips mechanically joined to form 1/2" x 1/2" x 1/2" cubes. Krueger Series EGC5.

2.5 EXHAUST AIR INLETS

A. Ceiling Exhaust Grille (CEG): Aluminum construction, "cube-core" or "egg-crate" type, with 0.025" thick x 1/2" deep strips mechanically joined to form 1/2" x 1/2" x 1/2" cubes. Krueger Series EGC5. Titus Series 50F.

B. Ceiling Exhaust Register (CER): Same as CRG but with opposed blade damper operable from face of register

C. Wall Exhaust Grille (WEG): Shall be of aluminum or steel construction, with 35 degree angular horizontal face bars. Unit shall have outer frame border, 1/4" wide, gasketed to prevent air leakage and minimize smudging. Deflecting bars shall be rigid extruded aluminum of semi-air-foil design, on 3/4" centers. Krueger Model No. S580H or S80H. Titus Series 350RL.

D. Wall Exhaust Register (WER): Same as WRG but with an opposed blade damper.

2.6 EXHAUST AIR INLETS AND TRANSFER GRILLES – SECURITY TYPE

A. Ceiling Return Grille – Security (CEG-S): Constructed of 12 gauge steel, with faceplate having 13/16” square holes on 1” centers, 1-3/4” border, and 3/16” diameter screw holes for mounting. Provide with 1-1/2” x 1-1/2” x 3/16” rear mount steel angle frame with welded on nuts for anchoring through face of grille to angle frame. Titus SG-LFO.

2.7 WALL CAPS

A. Dryer Vent Caps: Constructed of minimum 0.020-inch aluminum, hooded configuration, natural finish with integral backdraft damper. Inlet size to match connecting duct size. Artis DWVA, DWVSS (or approved equal).

2.8 ROOF CAPS

A. Sloped Roofs: Low profile rectangular roof cap, steel construction, with flashing base flange, downward facing outlet, outlet bird screen and spring loaded integral backdraft damper. Steel shall have an electrically bonded black finish or be of galvanized steel construction with black enamel finish. Throat area no less than the connecting duct free area. Flashing flange shall be minimum three inches larger all around than hood portion or as required by roofer to properly flash into roof; coordinate with Roofing Contractor and provide base flashing size as required. Greenheck RJ Series custom modified with

larger base (or approved equal).

B. Flat and Low Slope Roofs:

1. Cap: Round roof cap, aluminum construction, with bird screen and curb cap for installation on roof curb. Throat area no less than the connecting duct free area.
2. Roof Curb: Shall be constructed of minimum 18 gauge galvanized steel or 0.063-inch thick aluminum, of all-welded construction, with top wooden nailer (as required by roof/flashing type) held in place by metal wrap-around. Size of curb shall match roof cap used with, with minimum 8-inch high extension above the roof. Provide curb type (i.e., with built-in cant, base flashing, step height to allow for roof insulation, etc.) as required to match roof type (coordinate with Roofing Contractor). Greenheck Model GPR, GPS, GPF (GRS, (or approved equal).

2.9 ROOF VENTS

A. Type: Penthouse louvered type. Greenheck Model WIH, WRH (or approved).

B. Construction: Roof vents shall be constructed of galvanized steel, or aluminum and shall be designed for mounting on factory fabricated roof curbs. Roof vents shall have 1/2-inch mesh wire bird screen. Shall include mitered corners such that louver lines are continuous around vent.

C. Size: Roof vents shall have throat size as indicated on the plans (or size to match the connecting duct sizes indicated).

D. Roof Curb: Shall be constructed of minimum 18 gauge galvanized steel or 0.064-inch thick aluminum, of all-welded construction, with top wooden nailer held in place by metal wrap-around, and internally insulated with minimum 1/2-inch thick rigid fiberglass. Size of curb shall match roof vent. Provide curb type as required to match roof type (i.e., with built-in cant and step height to allow for roof insulation; sloped base; etc.). Greenheck Model GPR, GPS, GPF, or approved equal.

E. Dampers: Unless noted/detailed otherwise, dampers shall be counter balanced type. Size shall match roof vent throat size.

1. Gravity Type: Shall be of aluminum construction with neoprene or felt lined edges, interconnected with linkage.
2. Counter-balanced Type: Shall be as specified in Section 233300.
3. Motorized Type: Shall be as specified in Division 25. Actuator shall be provided by Division 25.

2.10 MISCELLANEOUS

A. Goosenecks: Shall be made of minimum 18 gauge galvanized steel, in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, and as shown on the drawings.

B. Screen: 1/2-inch mesh, constructed of either 0.051-inch aluminum wire or 19 gauge galvanized steel wire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install air outlets and inlets in locations indicated and so as to conform with building features and coordinated with other work.

B. Connections: Furnish all necessary screws, clips, duct collars, and transitions required to allow for the installation and connection of ductwork to all air outlets/inlets.

C. Location Verification: Verify all air inlet/outlet locations with building features and other trades prior to installing any duct systems that will connect to the air outlets/inlets. For locations where air inlet/outlet location is noted to be verified, or location is not clear, develop shop drawings showing the proposed location, or the location that best suits field conditions, and submit for review.

D. Painting:

1. Paint ductwork and accessories which are visible behind air outlets and inlets flat black. Painting to include ductwork, duct liner, turning vanes, liner attachments, and all visible items (including fastening pins for duct lining).
2. Coordinate with the Division 09 Contractor for any necessary painting of air outlets/inlets/louvers prior to installation.

E. Weather Exposure: All outlets and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness. Sealing and caulking of all outlets and inlets exposed to the weather shall conform to Division 07 and Section 200500.

F. Provide screened openings (SO) on all duct openings where indicated and where openings do not have grilles or registers.

G. Furnish door louvers to the Division 08 Contractor, who will install the door louvers in the doors.

H. Louver Blank-Offs: Where louvers require blanking off of unused area, use minimum 22 gauge galvanized sheetmetal, painted flat black on louver side, and insulated on building side with 2-inch duct liner (or thermally equivalent rigid fiberglass insulation). Tape off all raw edges of liner. Where exposed to view, provide galvanized sheetmetal cover (with bent over edges) to fully cover all insulation and match louver size.

I. Louver and Wall Caps: Slope bottom of all ducts within 18 inches of connecting to louvers and wall caps at minimum 1% slope toward bottom of louver; seal bottom water tight.

J. Louver Sizes: Contractor shall measure actual louver wall openings prior to ordering or fabricating louvers. Notify Architect/Engineer of any discrepancy between actual wall opening and specified opening.

K. Grilles, Security Type: Bolt through face of grille to angle frame above ceiling to “sandwich” building construction between grille faceplate and angle frame.

END OF SECTION 233700

SECTION 234000 - AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Air Filters.

B. Temporary Air Inlet Filters.

C. Filter Gauges.

1.3 SUBMITTALS

A. Submittals shall comply with Section 200500.

B. Submit product information on all products to be used.

C. Submit independent test lab data for all filters, showing air filter performance as tested per ASHRAE standards.

1.4 REFERENCES

A. ASHRAE 52.2: ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Filters: Camfil-Farr, Air Guard, American Air Filter.

C. Filter Gauges: Dwyer.

2.2 PLEATED THROW AWAY (PTA) FILTERS – MERV 13

A. Type: Filters shall be medium efficiency, pleated throw away type.

B. Efficiency: Filter media shall have efficiency as noted on the drawings, but no less than MERV 13. Efficiency shall be rated per ASHRAE Standard 52.2.

C. Resistance: Initial resistance of a 24" x 24" x 2" filter handling 2000 cfm shall not exceed 0.33" w.g.

D. Size: Filters shall be 4" deep (unless indicated otherwise), with number and sizes as required to give minimum nominal face area as indicated on the drawings.

E. Filter Track and Access:

1. Rooftop Units: Integral to unit, by unit manufacturer.
2. Furnaces and Heat Pumps: Custom fabricated filter track made of galvanized steel, located in mixed air plenum, enclosing filter on three sides, configured to hold filter with overlap at edges to prevent the bypass of unfiltered air. Filter access door shall be hinged with cam locks, not requiring tools for opening. Provide gasketing on access door (and elsewhere) so seal against filter and to prevent the bypass of unfiltered air.

2.3 PLEATED THROW AWAY (PTA) FILTERS – MERV 14

A. Type: Extended surface disposable filters, with foil laminated fiber board double-wall frame and dual-density microglass paper. American Air Filter VariCel II or approved.

B. Efficiency/Arrestance: MERV-14, 90-95% efficiency and 99% arrestance by ASHRAE 52.2-2007 and ASHRAE 52.1-1992.

C. Resistance: Initial resistance of a 24” x 24” filter handling 500 feet per minute shall not exceed 0.75” water column.

D. Size: Shall be 2-inches deep (unless indicated otherwise), with number and sizes required to give nominal face area as scheduled on the drawings.

2.4 PLEATED THROW AWAY (PTA) FILTERS – MERV 7

A. Type: Extended surface disposable filters, with foil laminated fiber board double-wall frame and dual-density microglass paper. American Air Filter VariCel II or approved.

B. Efficiency/Arrestance: MERV-7, 25-30% efficiency and 85% arrestance by ASHRAE 52.2-2007 and ASHRAE 52.1-1992.

C. Resistance: Initial resistance of a 24” x 24” filter handling 500 feet per minute shall not exceed 0.25” water column.

D. Size: Shall be 2-inches deep (unless indicated otherwise), with number and sizes required to give nominal face area as scheduled on the drawings.

2.5 TEMPORARY AIR INLET FILTERS

A. Type: Glass fiber or synthetic material blanket type filter media.

B. Capacity: Shall have an average efficiency no less than MERV 8.

C. Size: Minimum 1" thick, cut to size as required to cover inlets.

2.6 AIR FILTER GAUGE

A. An air filter gauge for measuring the resistance to air flow through the filters. The gauge

shall be diaphragm actuated, shall have 3-7/8" diameter white dial with black figures and graduations, shall have pointer zero adjustment and shall be furnished complete with two static pressure tips, fittings for 1/4" metal tubing and means for mounting the gauge.

B. 30% Filters: Gauge shall be Dwyer No. 2001-AF reading to 1" water in 0.02" division.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temporary Filters: Contractor shall provide temporary sealing of all duct systems during the construction period to prevent the entry to dirt, dust and debris into the duct systems. See Section 200500.

B. Systems that are operated during the construction period shall have temporary filters installed over all inlets and filters installed in the air handling equipment. Filters installed in equipment shall be same type as final filters required for the units. Temporary air inlet type filters shall be taped over all inlets to completely filter all air drawn into the systems, and shall be laid in front of equipment filters as well. All duct systems carrying return or exhaust or relief air prior to dust generating work being complete, shall be vacuum cleaned by a professional duct cleaning contractor.

C. Filters must be in place and sealed properly before using fans.

D. Provide three (3) complete sets of all filters in addition to any that the Contractor requires for the work (reference Section 200500 and 230594). Store as directed by Owner. One set shall be placed in units at time of that Owner takes building occupancy. Other 2 sets are for future Owner use. All sets shall be clean and new, unused.

E. Provide air filter gauge at each filter bank on all air handling units. Connect sensing tips to gauge with copper or aluminum tubing. Locate gauge in easily read position, provide brightly colored tape marker to indicate clean filter pressure drop and change-out pressure drop (use clean pressure drop plus 0.25" unless instructed otherwise).

F. LEED Photo Documentation: Contractor is responsible to provide electronic photos (.jpg format) of the following conditions:

1. Installed temporary inlet filters.
2. Protective caps on ductwork during Construction (Ref Section 233100).
3. Protection of ductwork prior to installation.
4. Installation of Initial Filters.
5. Installation of Final Filters.

END OF SECTION 234000

SECTION 237223 - PACKAGED DOAS UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section ~~230500~~ *200500* (Addendum 2) apply to this Section.

1.2 WORK INCLUDED

A. Dedicated Outdoor Air System (DOAS) Units.

B. Start-up.

C. Owner Instruction.

1.3 SUBMITTALS

A. General: Submittals shall comply with Section ~~230500~~ *200500* (Addendum 2).

B. Product Data: Submit product information on unit including fan curves, coil performance, unit construction details, wiring diagram, calculations showing heat recovery, and point of connection of all utilities.

1.4 GENERAL REQUIREMENTS

A. Standardization: All heat recovery units of the same type shall be the product of the same manufacturer.

B. Substituted Equipment: The drawings show design configuration based on a particular manufacturer's equipment (i.e. basis of design). Use of another manufacturer's equipment (i.e. substituted equipment) that is configured different from what is shown will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section ~~230500~~ *200500* (Addendum 2). The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, vibration unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the substitutional equipment shall be borne by the contractor. Contractor is cautioned that certain aspects of the equipment cannot be fully evaluated until items are installed and operational, and all added costs after installation to make units equal to the basis of design shall be by the Contractor.

C. Shop Drawing: Submit drawings of unit showing all dimensions and locations of unit

components.

D. Start-Up Report: Submit completed unit inspection and start-up report.

E. Operation and Maintenance: Submit Operation and Maintenance data and submittal data for inclusion in project O&M Manuals.

1.5 REFERENCES

A. AMCA 230: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

B. AMCA 300: Reverberant Room Method for Sound Testing of Fans.

C. AHRI 410: Standard for Forced Circulation Air Cooling and Air Heating Units.

D. ASHRAE 84: Standard for Method of Testing Air-to-Air Heat/Energy Exchangers.

E. ASTM D-2247: Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section ~~230500~~ *200500* (Addendum 2), Paragraph 2.1, Acceptable Manufacturers.

~~B. Heat Recovery Units: Innovent, Trane Custom, Silent-Aire.~~

B. DOAS Units: Trane, York, or approved equal. (Addendum 2)

2.2 GENERAL

A. Guards: All belt drives shall be equipped with belt guards. Exposed openings into fan housings shall be protected with substantial metal screens or gratings.

B. Drives: Shall be sized for not less than 150% of the rated motor horsepower.

C. Adjustable Sheaves: All belt drive fans shall have adjustable sheaves (except where motors are 5 hp and larger, fixed sheaves may be used). Sheaves shall be selected so that they are at their midpoint at the design conditions.

D. Bearings: Heavy duty, pillow block, self aligning ball type. Selected for minimum L-50 life of 200,000 hours at the maximum horsepower and operating speed for the fan class. All bearings shall be pressure lubricated with safety pressure relief grease fittings. All grease fittings shall be extended to accessible position. Bearing support bars shall be of structural channels of sufficient size and strength to insure flat bearing mounting surface and proper structural support. Bearing supports shall be constructed to allow for fan wheel removal. Bearings shall be bolted in place (welding is not acceptable).

E. Balancing and Shafting: The shafting of the fan shall be sized not to exceed 75 percent

of the first critical speed under the specified operating conditions, and the lateral static deflection of the shaft shall not exceed 0.003 inches per foot of the length of the shaft. The shaft and fan wheel(s) shall be dynamically balanced in two planes as a complete unit to a maximum residual unbalance of 0.15 oz. at 95 percent of the fan wheel radius in each plane.

F. Motors: Shall be UL listed and as specified in Section ~~230500~~ *200500* (Addendum 2).

G. Outlets and Inlets: Equipment shall be furnished with attachment angles and/or flanges as required for attaching ductwork as shown on the drawings.

H. Fan Performance: Shall be based on laboratory tests conducted in accordance with AMCA 230. Fan capacity shall not be less than the values scheduled on the drawings and shall be constructed to be able to operate with total pressures 20% higher than that indicated.

I. Fan Arrangement and Drive: Shall be as shown on the drawings and as required to accommodate installation.

J. Coils: Shall have the capacities scheduled on the drawings with air and water pressure drops not exceeding the values shown. Coils shall be certified in accordance with AHRI 410.

K. Controls: Coordinate with Division 25 Contractor for required interfaces between air handling equipment and building control system.

L. Gasketing: Where units are furnished in sections, unit manufacturer shall furnish unit with gasketing to allow sealing of adjoining sections.

M. Sound Tests: Shall be done by fan manufacturer in an AMCA certified sound testing laboratory. Sound tests shall be conducted in accordance with AMCA 300. Provide necessary testing and calculations to develop required sound data. Tested sound power levels shall not exceed specified levels by more than 3 dB in any octave band.

2.3 DOAS UNITS

A. Type: Outdoor heat pump, DOAS air handler with energy wheel heat exchanger.

B. General:

1. Unit shall be complete single package, self contained factory assembled unit, requiring only electrical, piping, and control connections to operate.
2. Capacity: Shall be as scheduled at the conditions noted.
3. Unit configuration shall be as shown on plans.

C. Casing:

1. General: Constructed of minimum 16 gauge G-90 galvanized steel or Series 3105 aluminum alloy, welded or bolted to minimum 10 gauge galvanized steel or aluminum frame. Unit shall be reinforced for maximum anticipated static pressure involved, but no less than 6" w.c. Unit shall have leakage less than 1%

of unit's scheduled capacity at 1.5 times the fan total static pressure scheduled. Unit roof shall be sloped for drainage, and be completely weather tight for outdoor installation. All seams shall be sealed to prevent leaks. Where bolted, fasteners shall be zinc plated type with neoprene washers.

2. Liner: Interior of cabinet shall be insulated with minimum 2-inch thick, 3.0 pound per cubic foot density fiberglass insulation applied with mechanical fasteners 12-inch on center. Provide with minimum 22 gauge galvanized steel solid liner inside entire unit.
3. Base: Fully welded, structural steel construction, with full perimeter steel (or aluminum) c-channel (or tubing) with inside angle for rooftop curb mounting. Provide steel (or aluminum) cross supports (tubing, channels, or angles) to insure unit rigidity. Provide base with lifting lugs to allow for crane lifting.
4. Floor: Double wall construction with minimum 16 gauge galvanized steel (or aluminum) inner floor, two inch thick rigid insulation, and 20 gauge galvanized steel (or aluminum) sub-floor. All floor seams shall be caulked and sealed.
5. Access Doors: Double wall construction, full size of section accessed (but not wider than 24") hinged type, with extruded aluminum doorframe, built in thermal break, and full perimeter gasket. Doors shall be opened by releasing multiple latches or similar method requiring no tools. Doors shall have a 12" round hermetically sealed double glazed laminated glass window. Provide access doors to each section of the unit.
6. Drain Pans: Drain pans shall be provided under all cooling coils, heat exchangers, mixed air sections and other areas where moisture may collect. Fabricate from 16 gauge 304 stainless steel, extend past cooling coil and heat exchangers to capture all carryover moisture. All pans are to be triple pitched for complete drainage with no standing water in the unit. Insulate with minimum 1/2" foam insulation, and have "Double Bottom" construction with welded corners. Provide stainless steel, 1-1/4"MPT drain connection (or as required by Code) extended to the exterior of the unit base rail. Units in excess of 160 inches in width shall have drain connections on both sides. All drain connections shall be piped and trapped separately for proper drainage. Furnish field installable p-traps for discharge of condensate to roof (or to a location as noted on plans).
7. Exterior Finish: All exterior surfaces shall be painted with a polyester resin paint system that is designed for long term corrosion resistance meeting or exceeding ASTM B-117 Salt Spray Resistance at 95 degrees F. 1,000 hrs. and ASTM D-2247 Humidity Resistance at 95 degrees F. 1,000 hrs. The color shall be selected by the Owner. Units with aluminum exterior finish do not require painting, but shall have a smooth, clean, natural aluminum finish.
8. Electrical Chases: Provide unit with necessary pipe and electrical chases to allow all connections to internal unit components, and to exterior piping and utilities. All piping shall be isolated from the air stream and shall be contained within the unit and protected from outdoor weather (except where specifically noted otherwise on plans). Bottom of chases shall have field installed blank-off plates of construction equivalent to unit casing.

D. Fan(s):

1. General: Steel construction, type and quantity as noted on plans. Fans shall be multi-blade centrifugal type.
2. Vibration Isolation: Fan(s) and motor(s) shall be mounted internally in the fan cabinet on an integral base. This assembly shall be isolated from the cabinet by

steel springs of 1" deflection and the fan outlet shall be isolated from the cabinet by means of a neoprene-coated flexible connection. Springs shall be free-standing, seismically housed steel type, with leveling bolts, selected to a maximum transmissibility of 5 percent. Isolator shall be mounted on a neoprene, or fiberglass, high frequency absorber with no metal-to-metal contact between the spring housing base and the base of the fan cabinet. Isolators restraints shall be rated for seismic zone 3, essential facility. Electrical grounding of the rotating assembly shall be done through the motor wiring. The fan motor shall be factory wired with a flexible conduit of adequate length so that it will not affect the vibration isolation to any appreciable degree.

3. Backdraft Damper: Provide exhaust fan with gravity backdraft damper.

E. Heat Recovery Wheel:

1. Type: Fixed plate type air-to-air heat exchanger, with diagonal style air flow.
2. Construction: Unit shall have aluminum plates and framing, with completely separated airstreams. Airtight sealant between adjacent airstreams shall be elastic synthetic resin adhesive suitable for temperatures of -40 degrees F to +212 degrees F. Unit shall be reinforced to withstand 10" W.G. pressure differential across surfaces without leakage or deflection of plates. Casing constructed of aluminum with full size pan under complete heat recovery coil entering and leaving air sections, and condensate drains.
3. Testing: Heat exchanger tested to ASHRAE Standard 84 for zero leakage, efficiency and pressure drop by an independent test lab. Submit test data.
4. Face and Bypass Dampers: Unit shall have face and bypass dampers to bypass outside air around the heat recovery coil for frost and temperature control (i.e. economizer). Controls shall be by Division 25.
5. Frost and Temperature Control Sequence: By Division 25, operating as follows:

    a. Frost Control: Temperature sensor on exhaust air side (leaving) heat recovery coil shall modulate dampers so that outside air bypasses the heat recovery coil to keep leaving exhaust air temperature above setpoint. Setpoint shall be adjustable, and shall initially be set at 33 degrees F.
    b. Temperature Control: See Division 25.

6. Recirculation and Bypass Dampers: Unit shall have recirculation dampers to allow return air flow to bypass unit heat recovery coil. Controls shall be by Division 25.

F. Compressor(s): Direct drive hermetically sealed or serviceable hermetic, scroll or reciprocating type, specifically designed for heat pump service. Compressor shall have internal line break overcurrent and overtemperature protection, low pressure protection, internal high pressure relief or high pressure switch, anti-short cycle timer, and crankcase heaters. Compressors shall be mounted on vibration isolators.

G. Refrigerant Circuit: Shall be fully factory piped and shall include a refrigerant line filter/drier, service pressure tap ports, reversing valve, accumulator, and thermostatic expansion valve (or dual flow metering device) for both heating and cooling operation.

H. Coils: Shall be constructed of seamless copper tubing with aluminum fins mechanically

bonded to tubes. Evaporator coils shall be factory leak tested to minimum 200 psig; condenser coils shall be factory leak tested to minimum 400psig.

I. Filters: Unit shall be designed to hold filter type as scheduled and as specified in Section 234000, with minimum face area (or velocity) as scheduled on the plans. Access for filter maintenance shall be through a full height service door on the side of the unit. Provide with magnehelic differential pressure gauge factory mounted and connected.

J. Outside Air/Return Air/Exhaust Air Section:

1. General: Unit shall have outside air, return air, and exhaust air dampers to allow for 0 to 100% outside air, 0 to 100% exhaust air, and full return air. Configuration shall be as shown on drawings (or manufacturers standard where not indicated).
2. Motorized Dampers: Low leakage dampers, airfoil blades, fabricated from galvanized steel, with neoprene, extruded vinyl or butyl rubber edge seals and flexible metal jamb seals. Bearings shall be nylon, molded synthetic, or oil impregnated sintered metal. Sized for maximum face velocity of 1500 feet per minute.
3. Backdraft Dampers: As specified in Section 233300.
4. Hoods/Louvers: Constructed of same material and finish as unit casing; with birdscreen. Size outside air intake for maximum of 800 feet per minute or so as to have no water intake. Size exhaust outlet for maximum of 1200 feet per minute.

K. Defrost: Unit shall have defrost cycle to remove build-up of frost on outdoor coil. Defrost cycle shall be time and temperature initiated, i.e. after 90 minutes (adjustable to lower time periods) elapsed run time if temperature is low enough defrost cycle shall be activated. Defrost cycle shall be time or temperature terminated, i.e. defrost cycle shall stop after 10 minutes or when refrigerant temperature is high enough indicating defrost is completed. When in defrost mode unit supplementary electric heaters shall be activated automatically.

L. Supplementary Electric Heaters: Shall be provided with capacity as scheduled on the drawings at the voltage and phase indicated. Heaters shall have open wire nickel-chrome elements, and safety overcurrent and overtemperature protection. Heaters shall be UL listed.

M. Electrical:

1. General: Unit shall be for use with single point electrical power connection. Unit shall be furnished with all necessary wiring, raceway, transformers, and accessories to connect power to all unit devices requiring electrical power (including lights, receptacles, and controls). Electrical shall comply with NEC and local code requirements. Unit shall have multiple fused power disconnects, arranged so that power serving the units lights and receptacles may remain powered when power to all other devices (motors, controls, etc.) is shut-off at other disconnects. Disconnects shall comply with NEC, be accessible from outside unit enclosure, able to be padlocked in the “off” position.
2. Control Compartment: Unit shall have a control compartment housing all unit motor starters, disconnects, vfd’s, and related components. Each fan shall be

provided with a motor starter (unless a VFD is shown), with hand-off-auto switch, and fused disconnect. Motor circuit protectors shall be magnetic trip, UL approved for motors with an "Off-On" handle accessible from outside the enclosure. Continuous current ranges and adjust able ranges shall meet NEC requirements for full-load and locked-rotor current. Adjustment instantaneous trip points shall be provided for full protection without nuisance tripping. Handles shall be able to be padlocked in the "off" position. Motor starters shall have ambient compensated bi-metal overload relays. Fan On/Off/Auto switch shall be oil and watertight. MCC enclosure doors shall have latches and defeaters to ensure door cannot be opened without the main disconnect being off or the defeater being deliberately voided.

N. ~~Controls: Shall be by Section 230933.~~ *Controls shall be by Division 25.* (Addendum 2)

O. ~~Curbs: Factory fabricated of minimum 14 gauge galvanized steel, height to suit overall elevation limitations. Factory designed to support unit weight, to seal weathertight, and to be compatible with roofing system used with.~~ *Curbs: Vibration Isolating Roof Curb as specified in 200548.* (Addendum 2)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the heat recovery units as shown on the drawings and in accordance with manufacturer's instructions.

B. All drains from plenums and drain pans shall be piped to the closest drain or as indicated on the drawings.

C. The drawings show design configurations based on particular manufacturer's equipment. If contractor's selected manufacturer's equipment configured different from that which is shown, the Contractor shall provide all necessary modifications to ductwork, support systems, electrical requirements, and piping systems as required to accommodate furnished equipment at no additional cost to the Owner.

D. Supplier shall include in bid, cost for changing sheaves on all belt driven fans to suit balancer or Engineer requirements.

E. Sheaves: Include in bid costs for sheave changes for all belt driven fans as required to suit balancer or Engineer requirements. If fewer fans require sheave changes a credit (i.e. deductive change order) will be issued.

3.02 START-UP

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, plumbing connections (where applicable), duct connections, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.

B. Testing and Adjustment: Operate unit in various modes of operation to test for proper operation, including fan rotation, proper damper travel (where applicable), proper

cooling/heating, correct interface to other controls (time clock, fans, etc.), coil temperature controls, etc. Tighten belts to proper tension, lubricate bearings, and make all other necessary adjustments, all per manufacturer's directions.

C. Final Check: When the testing and adjustment is complete, a final check of each unit shall be done by the manufacturer's authorized service representative, or direct employee, to verify proper unit operation. Any defective items shall be repaired or replaced by the contractor until proper operation is confirmed by the manufacturer's authorized service representative.

D. Written Report: When the final check has been completed, a written report from the manufacturer's authorized service representative shall be provided. This report shall list all units checked, items checked, check results, any items which may impair proper unit operation, and the name and phone number of the actual individual(s) doing the check. The report shall include a statement stating whether or not all units are operating as specified.

3.03 OWNER INSTRUCTION

A. After all testing and adjustments have been satisfactorily completed, the Owner shall be provided with operator instructions (including start-up, shut-down, emergency, maintenance, and repair instructions) by the manufacturer's authorized service representative.

B. Time Period: Instruction period shall be for a minimum of four (4) hours for each unique heat recovery unit or coil type.

C. Instruction and notification shall comply with Section ~~230500~~ *200500* (Addendum 2).

3.04 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 200800 – Commissioning of Mechanical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 237223

SECTION 237224 - CUSTOM DOAS UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 230500 apply to this Section.

1.2 WORK INCLUDED

A. Dedicated Outdoor Air System (DOAS) Units.

B. Start-up.

C. Owner Instruction.

1.3 SUBMITTALS

A. General: Submittals shall comply with Section 200500.

B. Product Data: Submit product information on unit including fan curves, coil performance, unit construction details, wiring diagram, calculations showing heat recovery, and point of connection of all utilities. Submit information showing compliance with ASHRAE 84.

1.4 GENERAL REQUIREMENTS

A. Standardization: All heat recovery units of the same type shall be the product of the same manufacturer.

B. Substituted Equipment: The drawings show design configuration based on a particular manufacturer's equipment (i.e. basis of design). Use of another manufacturer's equipment (i.e. substituted equipment) that is configured different from what is shown will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 230500. The redesign shall be equal or superior in all respects to the Architect/Engineer's design (as judged by the Architect/Engineer), including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, vibration unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the substitutional equipment shall be borne by the contractor. Contractor is cautioned that certain aspects of the equipment cannot be fully evaluated until items are installed and operational, and all added costs after installation to make units equal to the basis of design shall be by the Contractor.

C. Shop Drawing: Submit drawings of unit showing all dimensions and locations of unit components.

D. Start-Up Report: Submit completed unit inspection and start-up report.

E. Operation and Maintenance: Submit Operation and Maintenance data and submittal data for inclusion in project O&M Manuals.

1.5 REFERENCES

A. AMCA 230: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

B. AMCA 300: Reverberant Room Method for Sound Testing of Fans.

C. AHRI 410: Standard for Forced Circulation Air Cooling and Air Heating Units.

D. ASHRAE 84: Standard for Method of Testing Air-to-Air Heat/Energy Exchangers.

E. ASTM D-2247: Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500.

B. DOAS Units: Scott-Springfield, Innovent, Trane Custom, Silent-Aire.

2.2 GENERAL

A. Guards: All belt drives shall be equipped with belt guards. Exposed openings into fan housings shall be protected with substantial metal screens or gratings.

B. Bearings: Heavy duty, pillow block, self aligning ball type. Selected for minimum L-50 life of 200,000 hours at the maximum horsepower and operating speed for the fan class. All bearings shall be pressure lubricated with safety pressure relief grease fittings. All grease fittings shall be extended to accessible position. Bearing support bars shall be of structural channels of sufficient size and strength to insure flat bearing mounting surface and proper structural support. Bearing supports shall be constructed to allow for fan wheel removal. Bearings shall be bolted in place (welding is not acceptable).

C. Balancing: Fan shaft and fan wheel(s) shall be dynamically balanced in two planes as a complete unit to a maximum residual unbalance of 0.15 oz. at 95 percent of the fan wheel radius in each plane.

D. Motors: Shall be UL listed and as specified in Section 200500.

E. Outlets and Inlets: Equipment shall be furnished with attachment angles and/or flanges as required for attaching ductwork as shown on the drawings.

F. Fan Performance: Shall be based on laboratory tests conducted in accordance with AMCA 230. Fan capacity shall not be less than the values scheduled on the drawings and shall be constructed to be able to operate with total pressures 20% higher than that indicated.

G. Fan Arrangement and Drive: Shall be as shown on the drawings and as required to accommodate installation.

H. Coils: Shall have the capacities scheduled on the drawings with air and water pressure drops not exceeding the values shown. Coils shall be certified in accordance with AHRI 410.

I. Controls: Coordinate with Division 25 Contractor for required interfaces between equipment and building control system.

J. Gasketing: Where units are furnished in sections, unit manufacturer shall furnish unit with gasketing to allow sealing of adjoining sections.

K. Sound Tests: Shall be done by fan manufacturer in an AMCA certified sound testing laboratory. Sound tests shall be conducted in accordance with AMCA 300. Provide necessary testing and calculations to develop required sound data. Tested sound power levels shall not exceed specified levels by more than 3 dB in any octave band.

2.3 DOAS UNITS

A. Type: Custom outdoor DOAS air handler with plate and frame heat recovery.

B. General:

1. *Unit shall be complete single package, self contained factory assembled unit, requiring only electrical, piping, and control connections to operate.*
2. *Capacity as scheduled at the conditions noted.*
3. *Unit configuration shall be as shown on plans.*

C. Casing:

1. *General: Constructed of minimum 16 gauge G-90 galvanized steel or Series 3105 aluminum alloy, welded or bolted to minimum 10 gauge galvanized steel or aluminum frame. Unit shall be reinforced for maximum anticipated static pressure involved, but no less than 6" w.c. Unit shall have leakage less than 1% of unit's scheduled capacity at 1.5 times the fan total static pressure scheduled. Unit roof shall be sloped for drainage, and be completely weather tight for outdoor installation. All seams shall be sealed to prevent leaks. Where bolted, fasteners shall be zinc plated type with neoprene washers.*
2. *Liner: Interior of cabinet shall be insulated with minimum 2-inch thick, 3.0 pound per cubic foot density fiberglass insulation applied with mechanical fasteners 12-inch on center. Provide with minimum 22 gauge galvanized steel solid liner inside entire unit.*
3. *Base: Fully welded, structural steel construction, with full perimeter steel (or aluminum) c-channel (or tubing) with inside angle for rooftop curb mounting.*

Provide steel (or aluminum) cross supports (tubing, channels, or angles) to insure unit rigidity. Provide base with lifting lugs to allow for crane lifting.

4. *Floor: Double wall construction with minimum 16 gauge galvanized steel (or aluminum) inner floor, two inch thick rigid insulation, and 20 gauge galvanized steel (or aluminum) sub-floor. All floor seams shall be caulked and sealed.*
5. *Access Doors: Double wall construction, full size of section accessed (but not wider than 24") hinged type, with extruded aluminum doorframe, built in thermal break, and full perimeter gasket. Doors shall be opened by releasing multiple latches or similar method requiring no tools. Doors shall have a 12" round hermetically sealed double glazed laminated glass window. Provide access doors to each section of the unit.*
6. *Drain Pans: Drain pans shall be provided under all cooling coils, heat exchangers, mixed air sections and other areas where moisture may collect. Fabricate from 16 gauge 304 stainless steel, extend past cooling coil and heat exchangers to capture all carryover moisture. All pans are to be triple pitched for complete drainage with no standing water in the unit. Insulate with minimum 1/2" foam insulation, and have "Double Bottom" construction with welded corners. Provide stainless steel, 1-1/4"MPT drain connection (or as required by Code) extended to the exterior of the unit base rail. Units in excess of 160 inches in width shall have drain connections on both sides. All drain connections shall be piped and trapped separately for proper drainage. Furnish field installable p-traps for discharge of condensate to roof (or to a location as noted on plans).*
7. *Exterior Finish: All exterior surfaces shall be painted with a polyester resin paint system that is designed for long term corrosion resistance meeting or exceeding ASTM B-117 Salt Spray Resistance at 95 degrees F. 1,000 hrs. and ASTM D-2247 Humidity Resistance at 95 degrees F. 1,000 hrs. The color shall be selected by the Owner. Units with aluminum exterior finish do not require painting, but shall have a smooth, clean, natural aluminum finish.*
8. *Electrical Chases: Provide unit with necessary pipe and electrical chases to allow all connections to internal unit components, and to exterior piping and utilities. All piping shall be isolated from the air stream and shall be contained within the unit and protected from outdoor weather (except where specifically noted otherwise on plans). Bottom of chases shall have field installed blank-off plates of construction equivalent to unit casing.*

D. Fan(s):

1. *General: Steel construction, plenum type.*
2. *Vibration Isolation: Fan(s) and motor(s) shall be mounted internally in the fan cabinet on an integral base. This assembly shall be isolated from the cabinet by steel springs of 1" deflection and the fan outlet shall be isolated from the cabinet by means of a neoprene-coated flexible connection. Springs shall be free-standing, seismically housed steel type, with leveling bolts, selected to a maximum transmissibility of 5 percent. Isolator shall be mounted on a neoprene, or fiberglass, high frequency absorber with no metal-to-metal contact between the spring housing base and the base of the fan cabinet. Isolators restraints shall be rated for seismic zone 3, essential facility. Electrical grounding of the rotating assembly shall be done through the motor wiring. The fan motor shall be factory wired with a flexible conduit of adequate length so that it will not affect the vibration isolation to any appreciable degree.*
3. *Backdraft Damper: Provide exhaust fan with gravity backdraft damper.*

E. Heat Exchanger:

1. Type: Fixed plate type air-to-air heat exchanger, with diagonal style air flow.

2. Construction: Unit shall have aluminum plates and framing, with completely separated airstreams. Airtight sealant between adjacent airstreams shall be elastic synthetic resin adhesive suitable for temperatures of -40 degrees F to +212 degrees F. Unit shall be reinforced to withstand 10" W.G. pressure differential across surfaces without leakage or deflection of plates. Casing constructed of aluminum with full size pan under complete heat recovery coil entering and leaving air sections, and condensate drains.

3. Testing: Heat exchanger tested to ASHRAE Standard 84 for zero leakage, efficiency and pressure drop by an independent test lab.

4. Face and Bypass Dampers: Unit shall have face and bypass dampers to bypass outside air around the heat recovery coil for frost and temperature control (i.e. economizer). Controls shall be by Division 25.

5. Frost and Temperature Control Sequence: By Division 25, operating as follows:

a. Frost Control: Temperature sensor on exhaust air side (leaving) heat recovery coil shall modulate dampers so that outside air bypasses the heat recovery coil to keep leaving exhaust air temperature above setpoint. Setpoint shall be adjustable, and shall initially be set at 33 degrees F.

b. Temperature Control: See Division 25.

6. Recirculation and Bypass Dampers: Unit shall have recirculation dampers to allow return air flow to bypass unit heat recovery coil. Controls shall be by Division 25.

F. Compressor(s): Direct drive hermetically sealed or serviceable hermetic, scroll or reciprocating type, specifically designed for heat pump service. Compressor shall have internal line break overcurrent and overtemperature protection, low pressure protection, internal high pressure relief or high pressure switch, anti-short cycle timer, and crankcase heaters. Compressors shall be mounted on vibration isolators.

G. Refrigerant Circuit: Shall be fully factory piped and shall include a refrigerant line filter/drier, service pressure tap ports, reversing valve, accumulator, and thermostatic expansion valve (or dual flow metering device) for both heating and cooling operation.

H. Coils: Shall be constructed of seamless copper tubing with aluminum fins mechanically bonded to tubes. Evaporator coils shall be factory leak tested to minimum 200 psig; condenser coils shall be factory leak tested to minimum 400psig.

I. Filters: Unit shall be designed to hold filter type as scheduled and as specified in Section 234000, with minimum face area (or velocity) as scheduled on the plans. Access for filter maintenance shall be through a full height service door on the side of the unit. Provide with magnehelic differential pressure gauge factory mounted and connected.

J. Outside Air/Return Air/Exhaust Air Section:

1. General: Unit shall have outside air, return air, and exhaust air dampers to allow for 0 to 100% outside air, 0 to 100% exhaust air, and full return air. Configuration shall be as shown on drawings (or manufacturers standard where not indicated).

2. *Motorized Dampers: Low leakage dampers, airfoil blades, fabricated from galvanized steel, with neoprene, extruded vinyl or butyl rubber edge seals and flexible metal jamb seals. Bearings shall be nylon, molded synthetic, or oil impregnated sintered metal. Sized for maximum face velocity of 1500 feet per minute.*
3. *Backdraft Dampers: As specified in Section 233300.*
4. *Hoods/Louvers: Constructed of same material and finish as unit casing; with birdscreen. Size outside air intake for maximum of 800 feet per minute or so as to have no water intake. Size exhaust outlet for maximum of 1200 feet per minute.*

K. *Defrost: Unit shall have defrost cycle to remove build-up of frost on outdoor coil. Defrost cycle shall be time and temperature initiated, i.e. after 90 minutes (adjustable to lower time periods) elapsed run time if temperature is low enough defrost cycle shall be activated. Defrost cycle shall be time or temperature terminated, i.e. defrost cycle shall stop after 10 minutes or when refrigerant temperature is high enough indicating defrost is completed. When in defrost mode unit supplementary electric heaters shall be activated automatically.*

L. *Supplementary Electric Heaters: Shall be provided with capacity as scheduled on the drawings at the voltage and phase indicated. Heaters shall have open wire nickel-chrome elements, and safety overcurrent and overtemperature protection. Heaters shall be UL listed.*

M. *Electrical:*

1. *General: Unit shall be for use with single point electrical power connection. Unit shall be furnished with all necessary wiring, raceway, transformers, and accessories to connect power to all unit devices requiring electrical power (including lights, receptacles, and controls). Electrical shall comply with NEC and local code requirements. Unit shall have multiple fused power disconnects, arranged so that power serving the units lights and receptacles may remain powered when power to all other devices (motors, controls, etc.) is shut-off at other disconnects. Disconnects shall comply with NEC, be accessible from outside unit enclosure, able to be padlocked in the "off" position.*
2. *Control Compartment: Unit shall have a control compartment housing all unit motor starters, disconnects, vfd's, and related components. Each fan shall be provided with a motor starter (unless a VFD is shown), with hand-off-auto switch, and fused disconnect. Motor circuit protectors shall be magnetic trip, UL approved for motors with an "Off-On" handle accessible from outside the enclosure. Continuous current ranges and adjust able ranges shall meet NEC requirements for full-load and locked-rotor current. Adjustment instantaneous trip points shall be provided for full protection without nuisance tripping. Handles shall be able to be padlocked in the "off" position. Motor starters shall have ambient compensated bi-metal overload relays. Fan On/Off/Auto switch shall be oil and watertight. MCC enclosure doors shall have latches and defeaters to ensure door cannot be opened without the main disconnect being off or the defeater being deliberately voided.*

N. *Controls: Shall be by Division 25.*

O. *Curbs: Vibration Isolating Roof Curb as specified in 200548.*

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the heat recovery units as shown on the drawings and in accordance with manufacturer's instructions.

B. All drains from plenums and drain pans shall be piped to the closest drain or as indicated on the drawings.

C. The drawings show design configurations based on particular manufacturer's equipment. If contractor's selected manufacturer's equipment configured different from that which is shown, the Contractor shall provide all necessary modifications to ductwork, support systems, electrical requirements, and piping systems as required to accommodate furnished equipment at no additional cost to the Owner.

D. Supplier shall include in bid, cost for changing sheaves on all belt driven fans to suit balancer or Engineer requirements.

E. Sheaves: Include in bid costs for sheave changes for all belt driven fans as required to suit balancer or Engineer requirements. If fewer fans require sheave changes a credit (i.e. deductive change order) will be issued.

3.02 START-UP

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, plumbing connections (where applicable), duct connections, electrical connections, control connections, and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.

B. Testing and Adjustment: Operate unit in various modes of operation to test for proper operation, including fan rotation, proper damper travel (where applicable), proper cooling/heating, correct interface to other controls (time clock, fans, etc.), coil temperature controls, etc. Tighten belts to proper tension, lubricate bearings, and make all other necessary adjustments, all per manufacturer's directions.

C. Final Check: When the testing and adjustment is complete, a final check of each unit shall be done by the manufacturer's authorized service representative, or direct employee, to verify proper unit operation. Any defective items shall be repaired or replaced by the contractor until proper operation is confirmed by the manufacturer's authorized service representative.

D. Written Report: When the final check has been completed, a written report from the manufacturer's authorized service representative shall be provided. This report shall list all units checked, items checked, check results, any items which may impair proper unit operation, and the name and phone number of the actual individual(s) doing the check. The report shall include a statement stating whether or not all units are operating as specified.

3.03 OWNER INSTRUCTION

A. After all testing and adjustments have been satisfactorily completed, the Owner shall be provided with operator instructions (including start-up, shut-down, emergency, maintenance, and repair instructions) by the manufacturer's authorized service representative.

B. Time Period: Instruction period shall be for a minimum of four (4) hours for each unique heat recovery unit or coil type.

C. Instruction and notification shall comply with Section 200500.

3.04 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 200800 – Commissioning of Mechanical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 237224

(Addendum 2)

SECTION 237423 - PACKAGED OUTDOOR HEATING, MAKE UP AIR UNITS ONLY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Make-up Air Units.

B. Unit Roof Curbs.

C. Start-up.

1.3 QUALITY ASSURANCE

A. Units shall be rated in accordance with recognized standards and meet Code requirements for motor and combustion efficiencies.

B. Fan performance ratings shall be based on tests made in accordance with AMCA Standard 210.

1.4 SUBMITTALS

A. General: Shall comply with Section 200500.

B. Product Data: Provide complete product information submittals on all units; include performance capacities, fan performance (cfm vs. esp); and information on all filters and accessories.

1.5 GENERAL REQUIREMENTS

A. Standardization: All units shall be the product of the same manufacturer.

B. Substituted Equipment: The drawings show design configuration based on a particular manufacturers equipment. Use of another manufacturer's equipment (i.e. substituted equipment) that is configured different from what is shown will require redesign of mechanical ductwork, piping, electrical, structural, unit support systems, and general building construction to accommodate the substituted equipment. Such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. Make-Up Air Unit: Trane, Ice, Reznor, Rapid.

2.2 MAKE-UP AIR UNIT

A. Make-up air unit with electric heat for outdoor rooftop application with capacity and configuration as shown on plans.

B. Casing: The unit exterior casing shall be of minimum 18 gauge galvanized steel with enamel finish. The entire unit casing shall be insulated with minimum 1 inch thick 1.5-lb. fiberglass insulation with neoprene backing. The burner/heat exchanger section shall be stainless steel construction. An integral welded steel channel frame shall support the unit casing.

C. Blower/Motor Section: The fan section and motor assembly shall be constructed in accordance with AMCA standards. The assembly shall be designed to house the fan, bearings, motor, and v-belts which shall be selected for at least 50% above the rated motor capacity. Blower shall be belt drive with variable frequency drive where indicated. The blower wheel shall be statically and dynamically balanced, and mounted on a turned, ground and polished shaft with rigid bearing supports.

D. Filter /Outdoor Air/Return Air Section: Shall have rear outside air inlet, bottom return air inlet with integral dampers, and filters. Actuators and Controls by Division 25. Filters shall be 4" pleated throwaway, MERV 13 efficient type as specified in Section 234000, with minimum square footage as noted. Filter access shall be through a hinged side access door, requiring no tools to open.

E. Heater:

1. Type: Open coil type electric duct heaters; of size and capacity as shown on the drawings.
2. Listing: Heaters shall be UL listed for zero clearance to combustibles, and shall be built to meet all requirements of the National Electric Code and NFPA.
3. Construction: Heating coils shall be made of 80% nickel and 20% chromium coiled resistance wire. Coils shall be supported in an aluminized steel frame and insulated by floating ceramic bushings. Heaters shall be of the configuration to suit the application as shown on the drawings.
4. Overtemperature Protection: All heaters shall be equipped with primary and secondary overtemperature safety devices. The primary safety device shall be a disc or liquid filled bulb type with automatic reset; the secondary device shall be a disc type with manual reset, wired in series with each heater stage, set to trip at a higher temperature than the primary safety device.
5. Overcurrent Protection: Fuses shall be provided for overcurrent protection; fuse capacities shall be rated for at least 125% of the circuit amperage.
6. Proof of Air Flow: Where project’s control system is the DDC type, and heater is controlled by the DDC, proof of airflow is to be provided via the DDC system; no proof of airflow devices are required to be furnished integral with the heater. For non-DDC control systems or where the DDC control system is not providing heater control, provide heater with differential air pressure device and sensing tube (or sail flow switch), interlocked with the heater to prevent heater operation in case of insufficient airflow across the coil. Differential air pressure device (or sail flow switch) shall have sufficient sensitivity to suit velocity and duct

pressures of the application. Configure and arrange differential air pressure device (or sail flow switch) for proper operation as the application requires. Air differential air pressure device shall have a pitot tube on high pressure side installed to sense duct total air pressure; except where heater is used on the suction side of a fan, the air differential air pressure device shall be connected to the low pressure side and be configured sensor to measure static pressure only. Where sensitive enough differential air pressure devices (or sail flow switches) are not available, provide heater with 24 volt relay for interlocking to a fan proof device (i.e. motor starter auxiliary contacts, fan start relay, or equivalent).

7. Terminal Box: All heater controls shall be mounted in a side mounted terminal box, unless a separate remote mounted terminal box is shown on the drawings. Terminal box shall be insulated from the heater casing.
8. Disconnect: Heaters shall be provided with a built-in power disconnect switch, having a terminal door interlock.
9. Controls: Heaters shall be furnished with 24 volt transformer and shall be for use with 24 volt controls unless indicated otherwise. Transformer shall have secondary fusing, and transformers which are not class 2 shall have primary fusing. Mercury control contactors shall be used for controlling heater stages unless indicated otherwise. Where SCR control has been indicated the heater shall be furnished with a solid state proportional power controller allowing modulation of heater capacity from 0 to 100% of full capacity. The SCR control shall energize the heater only for the number of AC cycles necessary to produce the amount of heat required. For heaters with loads greater than 90 amps SCR control combined with a step controller in a vernier configuration (still providing full proportional control) is acceptable. (Backup or safety contactors - where used - shall be magnetic type).
10. Electrical: Heaters shall provide the output and number of control stages indicated. Three phase heaters shall have equal balanced three phase circuits. Heater element circuits shall be subdivided so that no circuit load exceeds 48 amperes. All internal wiring shall be suitable for 220 degrees.

F. Electrical Control Panel: Shall be factory wired for single point field connection, and include: Magnetic motor starter with thermal overloads, on/off/auto selector switch, line voltage/step transformers. Fuse blocks, terminal strip for field connection, of fan(s) and heater stages. All unit components requiring power or control shall be factory wired.

G. Temperature Controls: Unit shall be for use with controls furnished by Division 25 for temperature control.

H. VFD: Shall comply with VFD's specified in Section 237400.

I. Warranty: 5 years.

J. Factory fabricated heavy gauge steel curb, with horizontal base foot, top wood nailer wrapped over top with top of steel curb, and top gasket seal. Size, configuration, and capacity to match equipment served and roof slope installed on. Curb shall provide level watertight mounting surface for equipment served, and shall have provisions for seismic anchoring of unit to curb, and curb to building structure. Curb shall include seismic restraint reinforcing and calculations by a structural engineer licensed in the State of the project location showing forces imparted from the unit to the curb and from the curb to the roof structure as required by code and per requirements of Section 230548.

K. Adjustable Sheaves: All belt drive fans shall have adjustable sheaves (except where motors are 5 hp and larger, fixed sheaves may be used). Sheaves shall be selected so that they are at their midpoint at the design conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unit installation shall be in strict accordance with the manufacturer's requirements. Units shall be installed in locations shown on drawings. Units shall be level (or slightly sloped to drain) and aligned with building walls.

B. Unit casing shall be sealed to eliminate all leakage.

C. Unit shall be thoroughly cleaned of all debris and factory filter shall be removed prior to operation.

D. Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; and the Engineer has reviewed the system and granted approval.

E. Sheaves: Include in bid costs for sheave changes for all belt driven fans as required to suit balancer or Engineer requirements. If fewer fans require sheave changes a credit (i.e. deductive change order) will be issued.

F. Change sheaves on belt driven fans as directed by the Engineer or Balancer. Include in bid costs for one sheave change for each belt driven fan. Coordinate with balancer for new sheave requirements.

3.2 START-UP

A. Prior to air balancing and testing, check fans for correct rotation, tighten belts to proper tension, adjust fan rpm to value shown on drawings, and lubricate bearings per manufacturer's recommendations.

B. Subsequent to installation, and prior to air balancing, the installing Contractor shall perform functional tests and start-up for a minimum period of 3 days with various thermostat settings to assure proper operation over the full design range. Provide start-up report, listing all checks performed.

C. All air handling equipment shall be tested for proper fan operation, bearing integrity, and unit performance.

3.3 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 237423

SECTION 238126 - SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Air Conditioning Units.

B. Refrigeration Piping and Accessories.

C. System Leak Testing and Charging.

D. Start-Up.

1.3 SUBMITTALS

A. General: Shall comply with Section 200500.

B. Product Data: Provide complete product information on all units; include cooling performance capacities as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates, fan performance (cfm vs. esp), unit efficiencies, dimensions and information on all filters and accessories. Provide information showing dimensions and location of refrigerant, power, and control connections.

C. Installation: Submit manufacturer's installation instructions.

D. Submit air conditioning unit inspection and start-up report.

1.4 QUALITY ASSURANCE

A. Listing: Units shall be listed by an approved testing laboratory for the use and application intended.

B. Rating and Certification: Cooling performances shall be tested and rated in accordance with AHRI 210/240.

C. Applications: Units shall be intended for commercial use and shall include all manufacturers recommended accessories for proper operation for the application intended.

D. Code Compliance: Units shall be rated in accordance with recognized standards and meet code requirements for energy efficiencies. Units shall be constructed and designed to conform to applicable codes and standards.

E. Standardization: In interests of Owner's standardization, all equipment of the same type

shall be the product of the same manufacturer.

F. Operating Conditions: Unless more extreme temperatures are noted elsewhere, or required by local conditions or the specific application, unit shall comply with the following:

1. Unit and all components exposed to ambient conditions shall be able to withstand ambient temperatures from -10 deg F to 125 deg F, plus direct exposure to sun and weather elements without adverse affects.
2. Unit shall be able to operate and produce cooled air between ambient temperatures of 0 deg F and 125 deg F.

G. Alternate Manufacturers: The project has been designed around units by the manufacturer scheduled on the drawings. Alternate manufacturers may be used (see Acceptable Manufacturers, Paragraph 2.1 and Section 200500); however, any redesign (from what is shown on the drawing) to mechanical, electrical, structural or general construction to accommodate such an alternate manufacturer shall be provided by the Contractor. Furthermore, such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate unit installation plans and details; shop drawings shall comply with Section 200500. The redesign shall be equal or superior in all respects to the Architect/Engineer's design, including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate alternate manufacturers shall be borne by the Contractor.

H. Commissioning: See Division 01 and Section 200800 for commissioning efforts required.

1.5 WARRANTY

A. General: Entire unit shall be warranted to be free of all manufacturing defects and meeting all Contract Document requirements for a period of one year after Owner project acceptance.

B. Compressors: Unit compressors shall be warranted by the manufacturer for five years after Owner project acceptance. All labor and materials associated with compressor replacement and repair shall be warranted.

1.6 REFERENCES

A. AHRI 210/240: Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment

B. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.

D. ASTM B280: Standard Specification for Seamless Copper Tube for Air Conditioning

and Refrigeration Field Service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All products shall comply with Section 200500, Paragraph 2.1; Acceptable Manufacturers.

B. Air Conditioning Units: Mitsubishi.

C. Refrigerant Pipe and Fittings: Domestic manufacturers only.

2.2 AIR CONDITIONING UNIT

A. Type: Split system ductless air conditioner.

B. Indoor Unit: Wall (or ceiling) suspended unit (configuration as indicated on plans), with fan, adjustable discharge outlet, air filter, evaporator coil, refrigerant metering device, heavy gauge steel chassis, white plastic enclosure, controls, condensate pan and drain connection, and related accessories to operate properly with outdoor unit.

C. Outdoor Unit: Outdoor condenser and compressor unit, with high efficiency rotary compressor, condenser coil, condenser fan, accumulator, refrigerant piping, wind baffle accessory, heavy gauge steel chassis, baked enamel finish steel cabinet, controls, coil guard, mounting legs, and related accessories to provide capacity indicated.

D. Capacity: As scheduled on drawings at the conditions indicated. Unit shall provide cooling down to 0 deg F ambient. Unit shall be able to operate with refrigerant runs up to 164 feet long. Shall be rated in accordance with AHRI standards.

E. Refrigerant: Units shall be for use with refrigerant R-410A or R-407C.

F. Electrical and Controls: Indoor and outdoor units shall be provided with all contactors, relays, wiring terminals, safety controls, microprocessor devices, and accessories to allow for complete unit operation requiring only connection of room controller, power, and interconnection between indoor and outdoor units. Room controller shall be the electronic type, with liquid crystal display, room temperature sensor, on/off/auto functions, temperature setpoint, fan speed indicator, and self diagnostic display.

G. Condensate Pump: Provide unit with condensate pump. Where not available internal to unit, provide external type, with holding tank, controls, and gpm capacity at least 4 times unit condensate rate, at 10 feet of head. Provide mounting assembly and accessories for completely connected and functioning unit.

H. EMCS Interface: LonWorks controller to interface with Division 25 controls to allow for the specified sequence and communication indicated. Interface shall allow external enable/disable, reset of setpoint, equipment status, and alarm indication.

2.3 REFRIGERANT PIPING AND ACCESSORIES

A. Piping: Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed

joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary (i.e. when routing through sleeves, or similar poor access areas).

B. Sight Glass: Sight glass shall allow visual inspection of refrigerant flow and indicate refrigerant moisture content. Shall be double port type, solder end connections, for use with type of refrigerant of system being installed in, same size as tubing installed in. Henry type 3103 or equal.

C. Isolation Valves: Brass ball valve, full port, rated for 700 psig and -40 deg F to 300 deg F. Compatible with refrigerant used with, UL listed, with rupture proof encapsulated stem, extended copper connections for ease in brazing. Provide in configuration (i.e. angle, straight, with access port) as required to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install in strict accordance with manufacturer's written instructions and code.

B. Location and Arrangement: Install all equipment at locations and as shown on the drawings. Install so as to allow maximum access to unit. Prior to selecting unit final location, confirm that: proper unit clearances and access will be provided; no adverse airflow conditions are present; confirm location and installation details with other trades. Units shall be level and aligned with building walls. Set outdoor unit on concrete pad (or roof sleepers); anchor to pad (or sleepers).

C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation. See Section 232128 for cooling coil condensate drain piping.

D. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted. Piping shall be ran plumb and square to building walls, and in a neat professional manner. Provide sight glass in refrigerant liquid piping at outdoor unit.

E. Refrigerant Valves: Provide isolation valves on refrigerant piping connections at the outdoor unit (unless unit has integral service valves). Provide valve with access port on larger volume systems to aid in system vacuum testing (or as required for other purposes).

F. Refrigerant Charge: Units shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier.

G. Cleaning: Units shall be thoroughly cleaned of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

H. Operation: Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; system checkout has occurred; and the Engineer has reviewed the system and granted approval.

3.2 LEAK TESTING AND EVACUATION

A. Disconnect and isolate from the system any controls, relief valves, or other components that may be damaged by the test pressure.

B. Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 140 psig (or as required by the local Code authority).

C. Test all joints for leaks with a glycerin soap solution. Check the manifold gauge for any drop in pressure. Tap all solder/brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration.

D. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made.

E. When the above tests are successfully completed, allow the system to remain under test pressure (140 psig or as required by the local code authority) for 24 hours. Note the initial pressure and temperature. If the system pressure has not changed (when corrected to account for any change in temperature) the system may be considered free of leaks.

F. When all testing is completed the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and evacuate the system to 500 microns, and let stand for a minimum of 12 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.

3.3 START-UP

A. Initial Checks: Prior to unit operation, the system shall be inspected to insure all equipment and controls are properly connected and ready to operate. As a minimum, the following items shall be checked.

1. Adequate refrigerant charge.
2. Gauges installed to read suction and discharge pressure.
3. Proper voltage at outdoor unit.
4. Proper voltage at indoor unit.
5. Unit safeties properly set and connected.
6. Fan motors lubricated and ready to operate.
7. Temperature controls connected.
8. Pipe leak testing completed.
9. Condensate drain installed.
10. System service valves in proper position.
11. Controls properly connected and powered.

B. Initial Operation: After start-up, check unit for proper unit operation including: proper fan rotation, no excessive vibration, no unusual noises, proper unit cycling in response to

room temperature, no excessive room temperature swings, no safeties or electrical devices tripping out.

C. Written Report: Submit written report detailing all inspection procedures and findings leak test results, amount refrigerant charge installed, and final start-up/operation results.

3.4 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 238126

SECTION 238127 - VRF SPLIT-SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. VRF Split System Heat Pumps.

B. Refrigerant Piping.

C. VRF System Controls.

D. VRF System Interface to Division 25.

E. Start-up and Commissioning.

1.3 QUALITY ASSURANCE

A. Listing: Units shall be listed by an approved testing agency for the use and application intended.

B. Ratings and Certification: Unit performances shall be tested and rated in accordance with AHRI Standards and shall be AHRI certified.

C. Energy Efficiencies: Equipment energy efficiencies shall not be less than code requirements.

1.4 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Provide complete product information submittals on all units; include performance capacities as a function of indoor and outdoor coil db/wb temperatures and indoor coil air flow rates, supplementary heater capacity, fan performance (cfm vs. esp), and information on all filters and accessories.

C. Refrigerant Piping: Submit proposed refrigerant pipe sizes, schematic of routing, and refrigerant system accessories.

D. Control Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems, building floor plans with all proposed thermostat and other control device locations shown.

E. Installer Qualifications: Submit qualifications of the personnel installing the refrigeration system components and the system controls (when requested by the Engineer).

1.5 GENERAL REQUIREMENTS

A. System Type: System shall be a Variable Refrigerant Flow (VRF) heat pump system, allowing for simultaneous heating and cooling modes operation of indoor units, with indoor units operating independently of other indoor units, changeover from one mode to the other (heating to cooling, cooling to heating) with no interruption to system operation, and the recovery of energy between units in different modes. The system shall be capable of accommodating a range of the sum of all indoor unit capacity, from 50% to 150% of outdoor unit capacity.

B. Standardization: In interests of Owner's standardization, all system heat pumps and heat pump controls shall be the product of the same manufacturer.

C. Alternate Manufacturers: The project has been designed around equipment by the manufacturer scheduled on the drawings. Alternate manufacturers may be used (see Acceptable Manufacturers, Section 200500); however, any redesign (from what is shown on the drawing) to mechanical, electrical, structural, or general construction to accommodate such an alternate manufacturer shall be provided by the Contractor. Furthermore, such redesign shall meet the requirements and have the approval of the Architect/Engineer prior to fabrication. Contractor shall submit complete shop drawings showing all alternate installation plans and details; shop drawings shall comply with Section 200500. The redesign shall be equal or superior in all respects to the Architect/Engineer's design, including such aspects as equipment access, ease of maintenance, duct connection locations, unit electrical requirements, noise considerations, unit performance, and similar concerns. Cost of redesign and all additional costs incurred to accommodate the alternate heat pumps shall be borne by the Contractor.

D. Installer Qualifications:

1. General: The installer shall have experience installing VRF systems by the manufacturer being used for This project. Installer shall be certified by the VRF system manufacturer as a “certified installer”.
2. Refrigeration Components: Shall be installed by a licensed refrigeration mechanic having experience with VRF systems, and the work shall be supervised by personnel trained by the VRF system manufacturer.
3. Controls: Control work shall be done by individual trained and certified by the VRF manufacturer for the installation of the specified controls.

E. Warranty - VRF System Equipment:

1. Basic: Entire heat pump (outdoor and indoor sections) shall be warranted by the manufacturer to be free from all manufacturing defects and capable of providing satisfactory operation for the project warranty period. Repair and/or replacement of defective items (labor and parts) during the project warranty period shall be at no additional cost to the Owner.
2. Extended: Compressors and all coils shall be warranted by the manufacturer to be free from defects and capable of operating satisfactorily for a period of 5 years

beyond the basic project warranty. Extended Warranty shall cover all warranted parts and associated shipping to the site, with repair labor by the Owner.

F. Warranty - VRF System Controls:

1. Basic: System shall be warranted for the project warranty period to provide the sequence of operation and basic features specified, with the accuracy and flexibility specified. The system shall be repaired or replaced, including materials and labor, if in Owner's reasonable opinion, system is other than as warranted.
2. Emergency Service: During the warranty period maintain a 24 hour emergency phone service and be able to respond by a trained and qualified Controls Engineer familiar with the installed system.
3. Warranty Service Allowance: Include 8 hours of control technician/programmer's time for special service (i.e. software changes, system consultation, setting up additional trends, etc.) and other services during the warranty period as required by the Owner or Engineer. The Owner and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Owner may be tracked as part of this allowance. This allowance is for work outside of other required project work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.
4. End of Warranty Service: At the end of the warranty period, the Contractor shall provide a re-check of the entire system operation, including calibration testing of a sample number of components and providing any necessary control adjustments for proper system operation. Such work shall be for a minimum of 8 hours on site.
5. Extended Warranty: System shall be warranted for 2 years, beyond the project warranty period.

G. Refrigerant Pipe Sizing: Due to the use of proprietary selection criteria by the heat pump manufacturers. The heat pump supplier shall size all refrigerant piping between the indoor and outdoor units and provide such sizes to the installing Contractors prior to the bid date. The heat pump supplier shall also determine the need for any additional accumulators, solenoid valves, and similar accessories and size/select such devices and inform potential installing contractors to allow proper bids. The heat pump supplier is obligated to furnish complete heat pump units, with properly calculated pipe sizes and accessories so as to allow the unit performances as scheduled.

H. Electrical and Controls: Component wiring shall comply with NEC and be color coded and numbered and match unit wiring diagrams. All necessary terminal blocsk, fuse, wiring, junction boxes and electrical/control accessories shall be factory installed within the unit cabinet (unless noted otherwise).

I. Manufacturer's Installation Review: Upon completion of equipment installation, a technician employed directly by the manufacturer will be on site to confirm the installation is in compliance with the manufacturer's installation recommendations and to assist with equipment start-up. Upon completion of this installation review, the technician will submit a written report listing any installation issues, discrepancies or concerns within 72 hours of completion of manufacturer's review. Include in bid a minimum of 8 hours of a technician's time and all associated expenses. Notify the Engineer 5 days prior to the installation review.

J. *Manufacturer's Operational Review: Prior to substantial completion, a technician employed directly by the manufacturer will be on site to confirm the system is operating and controlling in compliance with the contract documents. Upon completion of the operational review, the technician will submit a written report listing any issues, discrepancies or concerns within 72 hours of completion of manufacturer's operational review. Include in bid a minimum of 8 hours of a technician's time and all associated expenses. Notify the Engineer 5 days prior to the installation review.* (Addendum 3)

1.6 REFERENCES

A. AHRI 210/240: Standard for Unitary Air Conditioning and Air Source Heat Pump Equipment.

B. AHRI 350: Standard for Sound Rating of Indoor Air Conditioning Equipment.

C. AHRI 270: Standard for Sound Rating of Outdoor Unitary Equipment.

D. AHRI 1060: Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

E. ASME B16.22: Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

F. ASME B16.26: Standard for Cast Copper Alloy Fittings for Flared Copper Tubes.

G. ASME B280: Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products shall comply with Section 200500, Paragraph 2.1, Acceptable Manufacturers.

B. VRF Heat Pumps: Mitsubishi, Trane.

C. Refrigerant Pipe and Fittings: Domestic made products only.

2.2 SPLIT SYSTEM HEAT PUMP - OUTDOOR UNIT

A. Type: VRF air-to-air heat pump, outdoor section, for serving multiple indoor units.

B. Capacity: Units shall allow the indoor units to have the minimum cooling and heating capacities scheduled on the drawings at the conditions shown; rated in accordance with AHRI standards.

C. General: Unit shall be fully factory assembled and shall be complete with casing, coils, fans, compressor, piping, wiring, controls, and all other accessories required to be ready for field connections and operation. Unit shall be capable of operating in the cooling mode from 30 to 125 degrees F ambient, and in heating mode from 0 to 65 degrees F ambient. Unit shall be factory run-tested to verify proper heating, cooling, defrost, control, and fan operation.

D. Unit Casing: Shall be constructed of galvanized steel, bonderized and finished with manufacturer's standard color. Casing shall be able to withstand 960 hours per ASTM B117 criteria.

E. Compressor(s): Shall be high performance, inverter driven, modulating capacity scroll type. Compressor shall have internal overcurrent protection and thermal overload protection, high pressure safety switch, and crankcase heaters. Compressor(s) shall be mounted to avoid transmission of vibration.

F. Refrigerant Circuit: Units shall be for use with refrigerant R-410A and shall be fully charged at the factory for the piping and indoor units used with. Unit shall include an accumulator with refrigerant level sensors and controls.

G. Coils: Shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing, with a factory applied corrosion resistant finish and integral metal guard protector.

H. Fan: Shall be direct drive, variable speed propeller type with a raised guard to prevent contact with moving parts. Fan motor shall have permanently lubricated bearings and inherent overcurrent protection.

I. Electrical and Controls: Units shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall have over-current protection and DC bus protection. Unit shall include all controls for units components, interconnection to other system components for automatic operation, safeties to prevent unsafe operation, to accommodate system defrost, and to allow for 8 stages of operation. Units controls shall be 24 volt.

J. Sound: Unit shall have a sound rating not higher than 60 db(A) individually, and 64 dB(A) where twinned. In "night mode" unit shall have a sound rating not higher than 50 db(A) individually, and 53 dB(A) where twinned.

2.3 SPLIT SYSTEM HEAT PUMP – INDOOR - CEILING CASSETTE

A. Type: Indoor VRF heat pump for overhead suspended installation in a ceiling (or at ceiling height).

B. General: Unit shall be fully factory assembled and shall be complete with fan, four way discharge outlet, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Unit shall have minimum cooling and heating capacities as scheduled on the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards.

D. Unit Casing: Fabricated of galvanized steel, with support provisions for hanging from building structure. Unit shall have bottom discharge grille, adjustable for two, three, or four-way discharge. Grille vane angles shall be adjustable via room wall thermostat. Exposed portion of unit shall have finished paint, manufacture's standard color.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to allow draining either end of unit. Unit shall have an integral condensate pump, rated for unit condensation rate and 2.5 feet of head.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor, manually adjustable guide vanes for side to side discharge, and a motorized discharge louver directing air up and down automatically. Air speed shall be adjustable via room wall thermostat.

H. Filter: Unit shall have an integral washable filter, easily removable.

I. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

2.4 SPLIT SYSTEM HEAT PUMP – INDOOR - WALL MOUNT

A. Type: Wall mounted indoor VRF heat pump, ductless.

B. General: Unit shall be fully factory assembled and shall be complete with fan, adjustable discharge outlet, evaporator coil, refrigerant metering device, heavy gauge steel chassis, refrigerant piping controls, condensate pan, drain connection, and related accessories to operate properly with VRF system.

C. Capacity: Units shall have minimum cooling and heating capacities as scheduled on the drawings at the conditions shown and with the outdoor unit indicated; rated in accordance with AHRI standards.

D. Unit Casing: Fabricated of galvanized steel, with wall mounting plate, and manufacturers standard white painted finish on exposed portion of unit. Unit shall have manually adjustable guide vanes for side to side discharge, and a motorized discharge louver directing air up and down automatically. Discharge louver automatic operation and position shall be adjustable via room wall thermostat.

E. Refrigerant Circuit: Shall be fully factory piped and shall include an electronic linear thermostatic expansion device to allow for both heating and cooling operation. Units shall be factory charged with dehydrated air (or an inert gas).

F. Coil: Non-ferrous construction with plate fins on copper tubing, with all joints silver brazed. Coils shall be factory tested to a minimum of 1.5 time's normal working pressure. Coil shall have corrosion resistant drain pan and drain fitting; configured to

allow draining either end of unit.

G. Fan: Direct drive, multi-speed type, statically and dynamically balanced, with permanently lubricated motor.

H. Filter: Unit shall have an integral washable filter, easily removable.

I. Electrical and Controls: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for unit's components, interconnection to other system components, and to provide the specified sequence of automatic operation. Unit shall include controls providing self-diagnostic checks, auto restart (on power outage or loss of control communication), test run switch, auxiliary contacts for control of an external heat source, four digital inputs for custom control applications, and three digital outputs for custom control applications.

J. Condensate Pump: Provide unit with condensate pump. Where not available internal to unit, provide external type, with controls, and gpm capacity to suit unit maximum condensate rate, at 10 feet of head. Provide mounting assembly, accessories for complete connections, and an architectural cover to match the finish of the unit to minimize visibility.

2.5 BRANCH CIRCUIT CONTROLLER

A. Type: Refrigerant Branch Circuit (BC) Controller controlling refrigerant flow and with controls and accessories for system heating/cooling operation.

B. General: The BC Controller shall be fully factory assembled, and complete with all piping, valves, controls, and wiring. Unit shall be factory run tested. Provide unit size and capacity appropriate for the system and number/size of indoor units.

C. Unit Cabinet: Fabricated of galvanized steel, sized to enclose all components. An integral condensate pan and drain connection shall be provided. Provided with factory supplied condensate pump.

D. Refrigerant Circuit: Unit shall have multiple two-position automatic refrigerant valves to control refrigerant flow, and each branch line shall have a service valve to allow servicing any indoor unit without interruption of service to other units. Unit shall have a liquid-gas separator a tube-in-tube heat exchanger. Linear electronic expansion valves shall be provided for control of refrigerant flow.

E. Electrical: Unit shall be for use with power of voltage and phase as scheduled on the drawings. Unit shall include all controls for proper operation interconnection to other system components

2.6 VRF SYSTEM CONTROLS

A. General: System shall come with VRF manufacturer's controls to control all space indoor units, heat recovery unit, and outdoor unit, as a unified system. System shall provide the sequence of operation specified.

B. EMCS: System controls shall have BACnet interface for connection to the building

EMCS, to allow EMCS to monitor system operation and to allow enable/disable of the overall system (i.e. placing in off or Auto modes remotely). Coordinate with Division 25 to ensure compatibility of controls.

C. Room Thermostats: Shall provide space temperature control for indoor units, completely independent of other indoor units. Thermostats shall include: occupant setpoint adjustment of plus or minus 3 deg F, room temperature display, relative humidity display, room setpoint display, fan speed adjust, indoor unit diagnostics, and discharge vane/louver adjust (where applicable).

D. Master Controller:

1. General: Shall provide time schedule, warm-up, optimum start, night setback and other control functions for the system and to serve as the users interface for system programming and setup. Shall be wall mounted, with visual display of all settings, and system diagnostics.
2. Scheduling:

    a. Time Schedules: The Control System shall provide time clock schedule with at least 20 time schedules. Each schedule to be 8-day type, 6 entries per day. All entries to be in 12 hour AM/PM format. The complete schedule shall be displayed at one time on the operator workstation for easy editing. Each time program shall be able to include on/off, high/low speed or duty cycle commands, or Analog Control Values as applicable for the application. Equipment may be assigned to named schedules, with master revisions to the schedule revising all assigned equipment.
    b. Holiday Schedules: A minimum of 24 holiday time schedules shall be available and shall be assigned to any number of available points.
    c. Holiday schedule shall display entire year and shall also allow for an interval holiday time, program showing holiday start date to end date (example: December 24 to January 2).

3. Warm-up Mode: Control System shall have warm-up mode prior to occupied mode on heating to pre-warm building prior to occupancy. Time of beginning warm-up cycle shall be determined by an optimum start/stop program.
4. Optimum Start/Stop: Control System shall have optimum start/stop program to reduce run time of HVAC equipment. Optimum start/stop program shall consider building mass, building temperatures, outdoor air temperatures, and other system factors in determining time of system start-up or shut-down. Program shall record previous warm-up times versus actual warm-up times and shall adjust the program algorithm so that program calculated warm-up time corresponds to actual.

E. Wiring and Conduit: As specified in Division 25 and 26, and in accordance with NEC.

F. Miscellaneous Control Components: Complying with Divisions 25 and 26. Standard components, for use in commercial and institutional occupancies, rated and designed for the application and able to provide the specified sequence of operation.

2.7 REFRIGERANT PIPING AND ACCESSORIES

A. Piping and Fittings: rated for system pressures per VRF system manufacturer. Hard drawn ACR copper tubing per ASTM B280, Type L, with silver brazed joints and wrought copper fittings per ASME B16.22. Use only long radius elbows. Flared fittings (at equipment connections only) shall comply with ASME B16.26. Soft copper tubing may only be used on runs less than 50-feet or where necessary (i.e. when routing through sleeves, or similar poor access areas) and where acceptable to VRF system manufacturer.

B. Isolation Valves: Brass ball valve, full port, rated for system pressures and temperatures, but no less than 700 psig and -40 deg F to 300 deg F. Compatible with refrigerant used with, UL listed, with rupture proof encapsulated stem, extended copper connections for ease in brazing. Provide in configuration (i.e. angle, straight, with access port) as required to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install system in accordance with code, manufacturers written installation instructions, and best construction practices. Set units in locations as shown on the drawings and maintenance to units.

B. Location and Arrangement: Install all equipment at locations and as shown on the drawings. Install so as to allow maximum access to units. Prior to selecting unit final location, confirm that: Proper unit clearances and access will be provided; no adverse airflow conditions are present; confirm location and installation details with other trades. Units shall be level and aligned with building walls. Set outdoor unit on concrete pad (or roof sleepers); anchor to pad (or sleepers).

C. Complete Connections: Connect and install all items shipped loose with units; provide and connect all utilities and accessories as required for proper unit operation.

D. Refrigerant Piping: Shall be silver brazed. Bleed dry nitrogen through piping during brazing to minimize oxidation. Keep all open ends of piping capped when not being worked. Soft copper shall have long radius bends; install without kinks or excess bends. Piping shall be routed concealed, except where routed outdoors and where noted. Piping shall be ran plumb and square to building walls, and in a neat professional manner.

E. Refrigerant Charge: System shall be checked for proper refrigerant charge and oil level and charged to proper levels after all leak testing and evacuation work has been completed. Refrigerant to be added to the system shall be delivered to the site in factory charged containers and charged into the system through a filter/drier.

F. Unit Protection: Units shall be protected during construction to prevent mud, dirt, paint overspray, plaster materials, and similar debris from depositing on the unit. Units shall be clean and in new condition prior to Owner acceptance.

G. Cleaning: Units shall be thoroughly cleaned of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

H. Operation: Units shall not be operated until all construction activities that generate dust, dirt, fumes, or odors are complete; system checkout has occurred; and the Engineer has

reviewed the system and granted approval.

3.2 VRF SYSTEM CONTROLS

A. General: Installation shall comply with Divisions 25 and 26. Provide all software, hardware, licensing, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters and all other devices required to provide a complete integrated VRF control system with the system features and sequence of operation specified.

B. Room Sensors: Room sensors (i.e. thermostats) shall be mounted at 48" above finished floor (unless indicated otherwise). Thermostats shall control the equipment which affects the temperature serving the space the thermostat is located in (unless indicated otherwise). Not all room sensors are shown on the drawings and the locations shown are preliminary only. Contractor shall review all drawings, coordinate with other trades, and indicate all final proposed room sensor locations on the submittal shop drawings. Contractor is responsible for coordinating locations to avoid furniture, monitors and other interferences.

C. Electrical Power:

1. General: Provide all electrical wiring and devices in accordance with codes, Division 25, and Division 26 requirements.
2. Sources: It shall be the responsibility of the installer of the VRF control system to provide power for all VRF control devices requiring power. Coordinate with the Division 26 Contractor to arrange for necessary power circuits. System Master Controller shall obtain power from a UPS (uninterruptible power supply); unless the unit has an internal battery back-up. Where the building has a generator, equipment served by the generator shall also have their control power served by the generator.
3. Conduit: All wiring shall be installed in conduit and in accordance with Divisions 25 and 26, except that low voltage wiring within the ceiling plenum spaces and in mechanical mezzanine areas may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.

D. Component Labeling: All control components, except regular room thermostats, shall be equipped with name plates to identify each control component. Components in finished rooms shall be labeled as to generic item controlled for better user understanding; other devices shall be labeled with the same designation which appears on the Control Diagrams. Contractor shall submit list of proposed labeling prior to installing.

E. Complete System: Provide all devices as required to allow for automatic control with sequence of operation specified. Provide all control interconnections between indoor and outdoor units, and other equipment.

F. Adjustability: All setpoints and differentials shall be adjustable. Setpoints indicated are initial settings.

G. Confirm Settings: Confirm with Owner all setpoints, all time schedules, and all other adjustable programming parameters before substantial completion.

H. Thermostats Setpoints: Shall be adjustable, with initial settings as follows unless indicated otherwise:

	Occupied Heating	Unoccupied Heating	Occupied Cooling	Unoccupied Cooling
Central Services Decon	60	60	65	65
Central Service (except Decon)	68	68	73	73
Tray Assembly	65	60	70	75
Kitchen	68	65	78	85
Warehouse	60	55	Lock-out Cooling	Lock-out Cooling
Pharmacy	70	65	75	85
All other spaces	70	65	75	85

I. Sequence Terminology: Wherever the control sequences refer to an article, device or piece of equipment in the singular number, such reference shall mean to include as many of such articles, devices, or equipment as are shown on the plans, required for the sequence, or required to complete the installation. Wherever the control sequence refers to an operating stage in the singular number, such reference shall mean to include as many stages as are specified for the equipment and shall mean analog (i.e. proportional) type control where specified for the equipment (reference drawings and equipment specifications).

3.3 VRF HEAT PUMPS - SEQUENCE OF OPERATION

A. General: VRF controls shall provide time schedule control and heating/cooling/fan operation of indoor units, with BC and outdoor units automatically operating in response to system loads and needs using their integral controls.

B. Occupied Mode:

1. Fan: Indoor fan shall cycle on and off as required to maintain occupied setpoints.
2. Heating: Indoor heat pump section shall operate in heating as required to satisfy the space setpoint.
3. Cooling: Indoor heat pump section shall operate in the cooling mode as required to satisfy the space setpoint.

C. Unoccupied Mode: Indoor fan and indoor heat pump heating/cooling shall cycle on and off as required to maintain unoccupied setpoints.

D. Mode Control: Units' mode of operation shall be determined by time schedule and time schedule override; warm-up mode shall be initiated by optimum start controls.

E. Outdoor unit and Refrigerant Controller: Shall operate to provide adequate and correct

refrigerant flow to serve indoor units and to reject or recover heat.

3.4 REFRIGERANT LEAK TESTING AND EVACUATION

A. Notification/Witnessing: Prior to beginning any testing, notify the Architect/Engineer when the testing will occur. The Architect/Engineer will witness (at his option) various parts of the test. Failure to notify the Architect/Engineer will be cause to re-test all piping in the presence of a representative of the Architect/Engineer.

B. Disconnect and isolate from the system any components that may be damaged by the test pressure.

C. Connect oil-pumped, dry nitrogen to the system through a pressure reducing gauge manifold. Charge enough nitrogen into the system to raise the pressure to 50 psig. Let stand for 2 hours and check for signs of leakage. If no leakage is noted, slowly increase pressure to 300 psig (or as required by local code, whichever is higher). Tap all brazed connections with a rubber or rawhide mallet sufficiently hard to start any leak that might subsequently open from thermal expansion/contraction or vibration. Check the manifold gauge for any drop in pressure. Let the system stand pressurized for 24 hours. Re-check the manifold gauge. If no change in pressure is noted (after adjusting for temperature) the system may be considered free of leaks.

D. If leakage is suspected or apparent, check joints with a glycerin soap solution or other means to locate the leaks. Repair any leaks found by completely disassembling the connection, cleaning the fitting and remaking the connection. Re-test the system after repairs are made both with pressure (300 psi for 24 hours) and at the leak location with a glycerin soap solution or other means of determining leaks.

E. When the system has been proven free of leaks with the above methods, the system shall be completely evacuated of all air and moisture. Connect a vacuum pump to the system and pump the system down to 500 microns and let stand for a minimum of 2 hours. If the vacuum reading remains unchanged, the system may be charged with refrigerant.

F. After satisfactory pressure testing and vacuum evacuation, fully charge the system with refrigerant. Any final connections that were not subject to the full test pressure (e.g. connections at unit, etc.) shall be carefully checked with a halide or electronic leak detector after the system has been charged.

3.5 START-UP/TESTING & ADJUSTMENT

A. Initial Checks: Prior to operating units, checks shall be made to insure that adequate voltage, air flow, duct connections, electrical connections, control connections, crankcase heaters (where applicable), and other items as listed by the manufacturer are properly provided/connected and operating to insure safe and proper unit operation.

B. Testing and Adjustment: Manufacturers representative shall provide start-up. Operate unit in various modes of operating to test for proper operation, including fan rotation, proper damper travel (where applicable), proper cooling/heating, correct interface to other controls (time clock, fans, etc.), etc. Make necessary adjustments.

C. System Commissioning: As the systems become operational, the VRF system installer

shall test and observe the operation of each and every air moving and heating/cooling unit and shall adjust all controls so that the items function according to the intent of the specifications. The VRF system installer shall commission the VRF system controls, including a point-to-point check of all devices, and provide documentation substantiating the work. This commissioning work is separate from the Section 230800 commissioning, and is to occur prior to the commissioning work of Section 230800.

D. Report/Statement: After making all necessary system testing and adjusting, the Contractor shall submit a report to the Engineer indicating all testing/adjustment work done and comment on how system is operating. Such report shall be signed by the individual directly responsible for supervision of the installation of the control system. When the Contractor feels that the system is complete and ready for review by the Engineer, Contractor shall submit a written statement (signed by same individuals as for report) stating that the system is in compliance with the project requirements and ready for review.

3.6 OWNER INSTRUCTION

A. Comply with Section 200500.

B. After all testing and adjustments have been satisfactorily completed, the heat pump owner shall be provided with operator instructions (including start-up, shut-down, emergency, maintenance, and repair instructions) by the manufacturer's authorized service representative.

C. Time Period: Instruction period shall be for a minimum of four (4) hours.

D. Instruction and notification shall comply with Section 200500.

3.7 COMMISSIONING

A. The Products referenced in this section are to be commissioned per Section 230800 - Commissioning. The Contractor has specific responsibilities for scheduling, coordination, startup, test, development, testing and documentation. At a minimum, the Contractor shall provide a documented and signed record to verify that all equipment and systems installed under this contract have been inspected and functionally tested to verify full compliance with the contract specifications.

B. The Variable Refrigerant Flow Zoning (VRFZ) system is to be commissioned per Section 019113 – General Commissioning Requirements and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

C. The VRFZ supplier shall provide a manufacturer certified technician to attend a Controls Integration Meeting (CIM). The CIM shall be conducted after the Energy Management and Controls System (EMCS) submittal and the VRFZ control submittal are complete and the CA has reviewed the submittals. The meeting is to be conducted prior to finalizing the functional test procedures and prior to installation and start-up. The CIM shall be attended by the Commissioning Authority, the EMCS controls contractor, the VRFZ control supplier and a representative of the Owner’s maintenance group at a

minimum. The CIM shall include, but not be limited to, the following topics:

1. Sequence of Operations
2. Alarm Points List
3. Trend Points List
4. Displayed/Adjustable Point List
5. Graphical Interface
6. Integration with packaged equipment
7. Point-to-Point Checkout and Commissioning of Existing Equipment
8. Method of Conducting Cx Functional Testing

D. The VRFZ supplier shall provide a manufacturer certified technician to perform start-up of the VRFC system and related controls per the manufacturer's recommendations and documentation.

E. The VRFZ supplier shall provide a manufacturer certified technician to support functional testing of the VRFZ system in conjunction with the functional testing of the Energy and Management and Control System (EMCS). The functional testing shall occur after all start-up activities are complete and start-up documents have been submitted and approved by the Commissioning Authority. The VRFZ supplier shall demonstrate that the required control interface functions with the EMCS are operational and the VRFZ parameters are configured per the sequence of operations.

F. The VRFZ supplier shall provide a manufacturer certified technician to support re-testing of any systems that did not pass functional performance testing criteria per the sequence of operations and commissioning requirements.

END OF SECTION 238127

SECTION 238246 - ELECTRIC HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Electric Heaters.

1.3 SUBMITTALS

A. General: Comply with Section 200500.

B. Product Data: Submit product information on all items.

1.4 GENERAL REQUIREMENTS

A. Listing: All heaters shall be listed by an independent testing laboratory for the application indicated.

B. Installation Verification: Prior to ordering units confirm finishes at heater location and type of installation and associated trim required; i.e. fully recessed, semi recessed, surface mount, etc.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products: Shall comply with Section 200500 Part 2.1 - Acceptable Manufacturers.

B. Unit Heaters: Q-Mark, Chromalox, Aztec, Berko.

C. Ceiling Radiant Heaters: Markel, Aztec, Indeeco, Q-Mark, Brasch.

D. Electric Radiant Heaters: Markel, Aztec, Indeeco, QMark.

2.2 UNIT HEATERS

A. Type: Fan forced, horizontal discharge unit heater. Q-Mark “MUH” series or approved.

B. Casing: Shall be die formed heavy gauge steel with factory baked enamel finish. Casing shall entirely enclose unit, and have adjustable louvers on unit discharge side.

C. Heat Elements: All steel or aluminum finned copper clad/steel type.

D. Motor and Fan: Draw through fan design; motor shall have permanently lubricated sealed

bearings with built in overload protection. Airflow rate shall be such that the temperature rise is no less than 30 deg F and no more than 50 deg F.

E. Controls: Safety controls shall include automatic reset high temperature cut-out and fusing (element, motor, and transformer primary) as required by the NEC. Unit shall include all contactors, relays and accessories to automatically operate fan or heater upon a call for either by a remote mounted thermostat (thermostat by Division 25).

F. Accessories:

1. Support: Steel support bracket for wall mounting.
2. Control: Low voltage thermostat, wall mounting type, adjustable 40 to 55 deg F.

2.3 CEILING RADIANT ELECTRIC HEATERS

A. Type: Ceiling, carbon element, electric radiant heaters.

B. Construction: Panel shall be constructed of minimum 24 gauge steel back, overlapping and riveted to a 22 gauge galvanized steel front. Back of heating element shall be insulated with minimum 1 inch thick 1 lb/cubic foot fiberglass. Units shall be for T-bar ceiling installation.

C. Heating Element: Shall be carbon (graphite) element, with no resistance wires. The surface shall be multi-faceted crystalline type with uniform watt density over entire panel face. Watt density shall be as required to provide capacity indicated on the drawings.

D. Warranty: Heater shall be warranted for 10 years.

2.4 RADIANT ELECTRIC HEATERS

A. Type: Electric overhead radiant heater, Markel THSS series.

B. Listing: Listed for indoor and outdoor installation.

C. Housing: Constructed of minimum 20 gauge stainless steel.

D. Reflectors: Gold anodized aluminum reflectors designed to deliver 96% of unit energy consumption as radiant heat, with 90 degree symmetric reflector pattern and four additional reflector patterns available (in symmetric and asymmetric arrangements of 30 degrees and 60 degrees).

E. Elements: Clear quartz lamp type, with tungsten filament in sealed halogen filled quartz tube.

F. Mounting Brackets: Steel mounts to allow for heater adjustment in 15 degree increments, up to 45 degrees above horizontal.

G. Control: See Division 25

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with Section 200500. Install in accordance with manufacturer's written instructions, code, applicable standards and best construction practices.

B. Coordination: Coordinate heater power and control requirements with other trades; confirm location of any required heater contactors, relays, thermostats, and similar devices. Provide any required wiring for proof of fan operation between fan devices and heater; wiring shall comply with the HVAC control portion of the specifications and Division 26.

C. Location and Trim Verification: Install equipment at locations indicated in accordance with the Contract Documents. Review and confirm installation locations, that proper clearances are provided, unit controls are accessible, and installation has been coordinated with other trades.

D. Complete Connections: Connect and install all items shipped loose with units; provide and connect all contactors, relays, wiring, interconnections and accessories as required for proper unit operation.

E. Cleaning: Units shall be thoroughly cleaned (internally and externally) of all debris prior to operation. Units shall be clean and in new condition prior to Owner acceptance.

F. Owner Instruction: Instruct Owner on equipment operation and maintenance.

3.2 START-UP

A. Pre Start-Up Inspection: Inspect equipment and connecting systems to confirm equipment and connecting systems to confirm equipment has been installed properly and is ready for start-up. As a minimum, check for: proper voltage and phases, correct electrical connections, complete control connections, all unit safety devices properly set and connected, coils clear of obstructions, and other items as listed by the manufacturer are properly provided/connected and operating to ensure safe and proper start-up. If items are discovered that prevent start-up to be completed, notify the installing Contractor and Engineer of issues. Coordinate and re-schedule start-up after items are corrected.

B. Start-Up: Perform start-up in accordance with manufacturers written start-up procedures. Observe proper operation of all unit components.

C. Adjustments: Adjust and set unit components to allow for proper operation. Observe unit to detect any unusual vibration, leakage, loose wiring, or other situations that could affect unit operation.

3.3 COMMISSIONING

A. Selected Division 23 equipment and systems referenced are to be commissioned per Section 019113 – General Commissioning and Section 230800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 238246

SECTION 25 08 00 – COMMISSIONING OF CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following section specifies general commissioning activities for this project:

01 91 13 GENERAL COMMISSIONING REQUIREMENTS

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

All Building Automation and Control Systems

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Commissioning General Requirements, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified 01 91 13, Commissioning General Requirements, Part 3 – Execution.

SCHEDULE A – Start-up Plan, Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed.

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Energy Management Control System						
Graphical interface plan						
Point-to-point and sensor calibration verification		CxA Provided				
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

SAMPLE

Contractor Checklist

Unit Type:	**Building Automation System**	Unit No:	**N/A**
Location:		Serves:	
Manufacturer:		Model:	

Check	RC	CxA	Note
Equipment			
Controllers mounted in panels per project documents			
Controller panels labeled per project documents			
Control wires and control devices labeled per project documents			
All control devices (actuators, sensors, etc) have been provided per the project documents			
Wires installed neatly in cable trays, D-rings, conduit, cable tied or plenum rated per requirements			
Front end computer and peripherals provided per project document specifications			
Surge protection and battery back-up devices installed per project documents			
External communication connected			
Common Sensors			
OSA sensor installation is complete			
OSA sensor location is appropriate with no artificial heat loads			
Photocell sensor installation is complete			
Photocell sensor location is appropriate with no artificial light sources			
Demand pulse meter installation is complete			
Gas pulse meter installation is complete			
Start-Up			
System graphics are complete, accurate and verified point-to-point			
Point to point testing and sensor calibration is complete			
Room temperature and other set points configured per owner			
Operating schedules have been set up per owner’s direction			
Alarms have been programmed and owner’s direction			
Access Security levels have been set up per owner’s needs			
Trend logs have been set up as directed by the CA			
Network connection is complete & remote access confirmed			
Point-to-point and calibration documentation submitted to CxA			
Readiness			
System is ready for functional performance testing			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

Building Automation System Point-to-Point Verification Data Sheet

Unit	Point Description	Type	Analog Input				Ref	Analog Output						Binary Input				Binary Output				Note
			Cal 1		Cal 2			Cal 1		Cal 2		Cal 3		On		Off		On		Off		
			BAS	FV	BAS	FV		BAS	FV	BAS	FV	BAS	FV	BAS	FV	BAS	FV	BAS	FV	BAS	FV	

BAS = Building Automation System
FV = Field Verify or Measure
Cal # = Descrete Calibration Point
Ref = Reference standard used to measure

Project: _____ Date: _____ By: _____
Ref: _____
Notes: _____
_____

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor shall be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that shall be conducted on this project. This table shall be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table shall be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A System Description	B Responsible Contractor	C Proposed Test Forms Received	D OK	E Testing Complete	F OK	G Notes
Energy Management and Control System						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Energy Management Control System (EMCS)
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule - B details the various methods of accomplishing functional testing.

Preliminary Activities:

A Controls Integration Meeting (CIM) shall be conducted after the controls submittal is complete and the CxA has reviewed the submittal. The meeting is to be conducted prior to finalizing the functional test procedures and shall be attended by the CxA, EMCS contractor, the VRFZ Control System contractor/supplier, mechanical engineer and a representative of the Owner's maintenance group at a minimum. The CIM shall include, but not be limited to, the following topics:

1. Sequence of Operations
2. Alarm Points List
3. Trend Points List
4. Displayed/Adjustable Point List
5. Graphical Interface
6. Integration with packaged equipment
7. Integration between control systems
8. Point-to-Point Checkout

Prior to any functional testing, a complete and documented start-up process shall have occurred. This includes point-to-point verification, sensor calibration and operational mode verification.

Prior to any graphical system development, the control contractor is to submit a System Setup Outline to the Commissioning Authority and Owner/Owner's representative for approval. The outline should describe the graphics to be provided along with a detailed list of the individual points to be displayed, screen linking, security levels, alarm management, schedules, trending, animation strategies, navigation, etc.

Trend logs shall be entered per the direction of the CxA to support demonstration of operation as outlined below for the performance period.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Shall Sample or Witness
C.2	CxA	Contractor	N/A	Up to 100%

The CxA shall develop a series of functional performance tests to be conducted by the contractor and as outlined below. Part 4 of this specification section includes sample functional test documents. These are samples only and do not reflect all functional test requirements. The contractor shall conduct the functional tests and turn over the completed functional test documentation and trend logs to the CxA. The CxA shall re-conduct a portion of the tests. The

contractor shall include time in their bid to support the CxA during this activity. This support does not include the normal point-to-point and operational verifications that should take place during start-up.

The EMCS and VRFZ control contractors shall make available to the CxA, at no additional cost, a method of interfacing with the control system at the building site. This interface shall be made available regardless of if a permanent local work station is specified in the contract documents or not. The interface shall be made available for the duration of the commissioning process and all commissioned systems are accepted. The EMCS and VRFZ control contractors shall also make available to the CxA, at no additional cost, a method of remotely accessing the system during the commissioning process and up to one year after system acceptance. Remote and local access shall include all software, licensing, software keys and anything else required to facilitate full access to the system. The local and remote interfaces shall include all contract required interfaces including, but not limited to, all graphics, trends and alarms. The CxA shall be given an account with full security access privileges to the system.

The contractor shall review the test plan provided by the CxA to verify the following:

1. The functional tests will not endanger the equipment or personnel in the facility.
2. The functional tests can be performed per the plan with the installed interface and equipment.

Functional Tests:

1) Functional testing to demonstrate proper operation of ALL modes of operation of all systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following equipment:

    a) Dedicated Outdoor Air System
    b) VRFZ Fan Coil Units
    c) Split System AC Units
    d) Makeup Air Unit
    e) Kitchen Exhaust
    f) Unit Heaters
    g) Paddle Fans
    h) Metering Systems
    i) Integrated systems (generator, fire, etc.)

2) Functional testing to demonstrate proper operation of ALL modes of operation of all systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following modes:

    a) Unoccupied mode
    b) Unoccupied limits
    c) Occupant override mode
    d) Optimal Start
        i) Heating mode
        ii) Cooling mode
    e) Warm-up mode
    f) Occupied mode
        i) Heating mode

ii) Cooling mode
iii) Energy recover mode – including economizer

3) Functional testing to demonstrate operation of all sub-systems under control of the automatic temperature control system and as described in the sequence of operations including but not limited to the following categories:

a) Fan control
b) Interlocked fan operation
c) Zone temperature control
d) Thermostatic control
e) Automatic damper control and modulation
f) Heating/cooling capacity
g) Alarm monitoring
h) Graphical user interface

4) System stability and control verification via trending (performance period). Trend logs to be set up by control contractor to demonstrate system performance, to include, but not limited to the following performance variables. Trend logs shall be set up for all inputs/outputs, both digital and analog, for all points in the system both physical and virtual. Trend interval shall be 5 minutes unless otherwise directed by the CxA. The minimum trend period shall be 14 days. Trend log point headings as displayed on system graphs and data tables shall be adequately descriptive for the point but no longer than 12 characters unless approved by the CxA. System default names are not acceptable. The heading titles shall contain no extraneous characters that are not needed to describe the point. The contractor shall provide the trends to the Commissioning Authority in electronic format, in MS Excel or a comma delimited file.

a) Zone temperature control
b) Morning warm-up verification
c) Optimum start-stop verification
d) Water and electrical usage

5) Functional testing of all equipment protections monitored by the automatic temperature control system, safeties and alarms including but not limited to the following modes:

a) Smoked detector, fire alarm shutdown for air handling equipment
b) VRFZ parameter failures
c) Dirty filter status
d) Fan failure and alarms
e) Phase loss protection

PART 4 – SAMPLE FUNCTIONAL TEST DOCUMENTS

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that shall be required from the contractor. These forms and procedures shall be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that shall be required to be executed by the contractor.

Automatic Temperature Control Functional Test Samples
FCU or AHU w/ Heating, Cooling & Economizer

Unoccupied Mode

1. Place the control system in the unoccupied mode by changing the schedule.
2. Verify that all controlled points listed are off, OSA dampers are closed.
3. Verify by direct observation that all controlled points are off and dampers are in the correct position.

AHU:					
Supply/Return fan command displayed OFF					
Supply/Return fan status displayed OFF					
Supply/Return fan, observed OFF					
Heating command displayed					
Cooling command displayed					
OSA damper position displayed CLOSED					
OSA damper position, observed CLOSED					
Return air damper position displayed OPEN					
Return air damper position, Observed OPEN					
Relief damper position displayed CLOSED					
Relief damper position, observed CLOSED					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Unoccupied Limits

1. Place the system in the unoccupied mode and verify all AHUs are off and heating, economizer and cooling are not locked out.
2. Simulate a zone temperature below the unoccupied low limit.
3. Verify unit comes on in full recirculation and heating system modulates to control zone temperature.
4. Verify unit stops when zone is satisfied.
5. Simulate a zone temperature above the unoccupied high limit
6. Verify unit comes on in cooling and the system modulates to control zone temperature.
7. Verify unit stops when zone is satisfied.
8.

Unoccupied Limits

AHU:					
Pre-Test:					
Unoccupied low limit					
Unoccupied high limit					
Zone temperature					
Test:					
Unoccupied low limit changed to:					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

Unoccupied High Limit

Unoccupied high limit changed to:					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

☐ Set points returned to original values.

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Unoccupied Occupant Override – AHU

1. Place the system in the unoccupied mode and verify all AHUs are off.
2. Set the override period to a minimum value.
3. Simulate a call for heating or cooling as required, test a minimum of two each for heating and cooling.
4. One at a time, press the override button for each space.
5. Verify the AHU goes into the occupied mode and system is in heating or cooling.
6. Verify unit stops at end of time period.

AHU:					
Pre-Test:					
Override run time					
Zone temperature					
Zone set point					
Test:					
Override run time adjusted to					
Zone temperature set point adjusted to					
Heat Test or Cool Test					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off at end of override					

☐ Set points returned to original values.
☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Occupied Mode Tests

1. Place the system in the occupied mode by changing the schedule.
2. Verify by direct observation that the supply fan starts, the air dampers modulate to normal position (minimum air or higher), heating and cooling is set to control to current set point, relief dampers open and other parameters are normal.
3. Verify BAS displays the correct status for the units.

AHU:					
Space temperature					
Space temperature set point					
Supply/Return fan command displayed					
Supply/Return fan status displayed					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
System off when satisfied					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Zone Control - Cooling

1. Verify outside air is below economizer lockout temperature.
2. Lower the zone set point slightly below the current zone temperature.
3. Verify outside air dampers open for economizer cooling and DX cooling remains off.
4. With an increased call for cooling, verify DX cooling is activated.
5. Mixed Air Low Limit: Simulate a mixed air temperature below the mixed air low limit set point and verify mixed air low limit overrides the economizer control by closing the outside air damper. Release low limit when done.
6. Economizer Lockout1: Simulate an OSA temperature above the return air temperature and verify OSA dampers modulate to minimum position. Release when done.
7. Economizer Lockout2: Simulate an OSA temperature above the Economizer Lockout Set point and verify OSA dampers modulate to minimum position.
8. Raise set point to eliminate a call for cooling.
9. Cooling with economizer lockout: With economizer locked out. Create a demand for cooler air. Verify cooling is activated immediately.

Cooling Control:

AHU:					
Pre-Test:					
Zone temperature					
Zone set point					
Outside air temperature					
Economizer minimum set point					
Economizer lockout set point					
Economizer damper position					
OAT					
RAT					
MAT					
DAT					
Mixed air low limit set point					
Test:					
Zone set point lowered to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature after 3 minutes					
Economizer is first stage of cooling					
Zone set point lowered to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature					
Discharge air temperature after stabilization					
Mechanical cooling coil is second stage of cooling					

Limits

AHU:					
Mixed Air Low Limit					
Mixed air low limit set point changed to					
Outside air dampers close to control to MLL					
Economizer Lockout					
Dampers to minimum position on economizer lockout based on return air					
Dampers to minimum position on economizer lockout based on outside air					
Cooling control during economizer lockout:					
Zone set point lowered to					
Cooling command displayed					
OSA damper position displayed					
Supply air temperature after stabilization.					
RAT					
MAT					
Mechanical cooling is first stage of cooling					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Zone Control - Heating

While system is still in cooling, simulate a zone temperature below the zone temperature set point.
Verify economizer is at minimum.
Verify discharge air temperature set point is reset higher in response to heating demand.
Verify heating operates to control to set point.

Heating Control:

AHU:					
Pre-Test:					
Economizer minimum set point					
Zone temperature					
Zone set point					
Test:					
Set point raised to					
Heating command displayed					
Cooling command displayed					
OSA/Relief damper position displayed					
Return air damper position displayed					
Return air temperature					
Mixed air temperature					
Outside air temperature					
Discharge air temperature after 3 minutes					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Comments:

Thermostat Calibration and Point to Point Test

1. At each thermostat location, press override push button (or raise/lower setpoint).
2. Verify that BAS indicates correct zone in override.
3. Measure room air temperature and record actual and BAS indicated temperatures.

Unit No.	Override	Room Temp	BAS Temp	Unit No.	Override	Room Temp	BAS Temp

☐ Set points returned to original values.

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
CxA:			

Comments:

AHU Hard Wire Shutdowns:

1. Mixed Air Low Temperature: Trip freeze stat and verify fan shuts down and dampers close.

AHU:					
Shutdown on freeze					
Reset OK					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Installing Contractor:			
CxA:			

Comments:

Exhaust Fans

BAS Controlled Exhaust Fan Test (with Fan Proof)

1. Place the control system in the unoccupied mode.
2. Verify all exhaust fans under BAS control are commanded off, display an off status and are off by physical inspection (PI).
3. Place the system in the occupied mode.
4. Verify all exhaust fans under BAS control are commanded on, display an on status and are on by physical inspection (PI).
5. Turn off the exhaust fan at the disconnect and verify fan failure alarm is generated.
6. Turn power to fan back on and verify alarm clears.

EF-	1	2	3	4	5
Unoccupied Mode:					
Exhaust fan command displayed OFF					
Exhaust fan status displayed OFF					
Exhaust fan, PI OFF					
Occupied Mode:					
Exhaust fan command displayed ON					
Exhaust fan status displayed ON					
Exhaust fan, PI ON					
Exhaust fan failure alarm received					
Exhaust fan failure alarm cleared					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
CxA:			

END OF SECTION 250800

SECTION 255000 - INTEGRATED AUTOMATION FACILITY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 SECTION INCLUDES

A. Control system design.

B. Complete mechanical system controls.

C. Control devices, components, and wiring.

D. Control system commissioning.

1.3 BIDDING

A. General: See Division 01 for alternates and Division 00 for related requirements.

B. Base Bid: No controls.

C. Alternate 1A: Andover Control system provided by local branch office. *Point of Contact for Andover system: Building Control Systems, (425)774-1680.* (Addendum 3)

D. Alternate 1B: Johnson Control system provided by local branch office.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for all items to be used. Provide a complete materials list, labeled to match labeling used on shop drawing, with manufacturer and model number. Clearly indicate specific each item’s control features (e.g. range of operation, accuracy, electrical characteristics, material of construction, etc.). Provide a schedule listing all control valves, control dampers, sizes, flow rates, pressure drops, Cv's, and related data to clearly identify application.

B. Shop Drawings: Submit shop drawings of complete control system, including the following information: interconnect drawings showing all wiring and control connections, all control device locations, sequence of operation for all controlled systems, building floor plans with all proposed thermostat and other control device locations shown.

C. Labeling: Submit list of proposed component labeling.

D. Commissioning Reports: Submit documentation showing commissioning work and results.

1.5 QUALITY ASSURANCE

A. Listing: All network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

B. Electrical Interference: All electronic equipment shall conform to the requirements of FCC 15, governing radio frequency electromagnetic interference and be so labeled.

C. Skilled Workers: The entire control system shall be installed by skilled electricians, technicians, and programmers, all of whom are experienced, properly trained and qualified for the work they perform. Contractor shall submit evidence of workers' experience and training upon request of the Engineer.

1.6 GENERAL REQUIREMENTS

A. Single Contractor: One single Company shall be responsible to design, furnish and install the complete Division 25 control system. Any subcontracted installation work shall be done by firms experienced and qualified in the work they perform, and subject to approval by the Engineer.

B. Local Contractor: System shall be designed, programmed, and commissioned by local office personnel, with their office facilities, located within 100 miles of the project location.

C. Licensing: Provide licensing which allows the Owner to make modifications, additions, expansion, and interconnections to all aspects of the system without limitation. Manufacturer's software licensing agreements shall be configured to allow the system to be "open" and non-proprietary. The Owner shall have full ownership for the system and access.

D. Payments: The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. punchlist work) as specified elsewhere, the work of this specification Section may be limited to a maximum payment of 90% of the scheduled value of the work until all system are proven operational and have been properly checked out by the installing Contractor.

E. Service Allowance: Include 24 hours of control labor for special work (i.e. software changes, system consultation, relocation of control devices and other services) during construction as required by the Owner or Engineer. The Engineer and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Engineer may be tracked as part of this allowance. This allowance is for work outside of other required project work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.

F. Programming Point Names: Custom point naming is required to match the Owner's standard point naming scheme. Coordinate with Owner to confirm standards.

G. Spare Parts: Contractor shall furnish the Owner with minimum of the following spare parts, of same type as used in this project:

1. Two spare terminal control unit.

2. Two current sensing relays as used on fans.

H. Warranty:

1. Basic: System shall be warranted to provide the sequence of operation and basic features specified, with the accuracy and flexibility specified. The system shall be repaired or replaced, including materials and labor, if in Owner's reasonable opinion, system is other than as warranted.
2. Emergency Service: During the warranty period maintain a 24 hour emergency phone service and be able to respond by a trained and qualified Controls Engineer familiar with the installed system. The Contractor shall be able to communicate with the system for purposes such as program algorithm alterations, operational evaluations, trouble-shooting, etc.; said response shall be within six hours, with site visits (as necessary) in no less than two weekdays.
3. Warranty Service Allowance: Include 40 hours of control technician/programmer's time for special service (i.e. software changes, system consultation, setting up additional trends, etc.) and other services during the warranty period as required by the Owner or Engineer. The Owner and Contractor will jointly track the amount of time used. Only time directly authorized and agreed to by the Owner may be tracked as part of this allowance. This allowance is for work outside of other required project work, and is for specific tasks assigned to the Contractor by the Owner or Engineer.
4. End of Warranty Service: At the end of the warranty period, the Contractor shall provide a re-check of the entire system operation, including calibration testing of a sample number of components and providing any necessary control adjustments for proper system operation. Such work shall be for a minimum of 8 hours on site.
5. Extended Warranty: System shall be warranted for 18 months.

1.7 REFERENCES

A. UL 916: Energy Management Equipment.

B. FCC 15: Code of Federal Regulations, Title 47, Part 15, Federal Communications Commission Regulations.

C. AMCA 500-D: Laboratory Methods of Testing Dampers for Ratings.

D. ANSI/ASHRAE 15: Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General: Products shall comply with Section 200500. See Section 200500, paragraph 2.1 for Acceptable Manufacturer requirements.

B. Microprocessor Based Products: Andover, Johnson.

C. Actuators: Belimo.

D. Control Valves: Honeywell, Armstrong, Belimo, Siemens, TA Hydronics.

E. Local Workstation Computer: Dell, Sony, Hewlett-Packard, Toshiba.

F. Local Workstation Printer: Hewlett-Packard, Epson, Canon, Brother.

G. Control Dampers: Ruskin, American Warming and Ventilating, Greenheck.

H. Variable Frequency Drives (VFD's): ABB, Danfoss-Graham.

I. Carbon Dioxide Sensors: Vulcan, Vaisla, Honeywell.

J. Other Control Components and Accessories: Idec, Hoffman, McDonnell, Tridelta, Veris, Kele, Edwards, Mamac, APC, Barksdale, Mark-Time, Functional Devices, and manufacturers listed for microprocessor based products.

2.2 BASIC SYSTEM

A. General: The system shall be a distributed processing type direct digital control (DDC) system. System shall provide complete stand-alone temperature control/monitoring and energy management for this project, using a network of various independent controllers, sensors and associated devices interconnected in a communicating network.

B. System Protocol: System shall utilize an open (i.e. non-proprietary) communications protocol which allows the use of control components by different manufacturers to be installed as part of the system with automatic adaption and incorporation into the system with minimal programming. System shall be a BACnet compliant type with all component communication using the protocols and standards as defined by ANSI/ASHRAE 135. System shall be internet accessible using standard web browsers such as Windows Explorer and be based on Tridium "Niagara AX" software utilizing Jace controllers.

C. Version: System shall be latest version of the manufacturer’s standard commercial building DDC system.

D. Expansion: System shall have a fully modular architecture, allowing expansion through the addition of controllers, and control devices. System shall have capability to increase capacity by 50% (i.e. as many points as system currently has) without requiring software upgrades or revised licensing.

E. Network: All controllers shall be interconnected in a communicating network to provide facility wide access to work stations and sharing of information. A Local Area Network (LAN) shall be provided to interconnect controllers for high speed data transmission. Failure of a single or multiple controllers shall not cause loss of communication between other LAN-connected controllers still active. The control system LAN shall be separate and independent from other building LAN’s (except for a single data terminal connection at a single system workstation).

F. Full DDC: All items to be controlled/monitored shall be by DDC. No line voltage thermostats, line voltage switches, etc. that provide direct system control are allowed, unless specifically noted otherwise

G. System Performance:

1. Graphics: System shall display a graphic with at least 20 dynamic points with all current data within 10 seconds of being initially displayed. System shall refresh a graphic with at least 20 dynamic points with all current data within 8 seconds.
2. Object Command: Commands of a binary object entered at local workstations shall be executed at the commanded device within 2 seconds of being entered; analog objects shall start to adjust within 2 seconds.
3. Current Data: Any data used or displayed at a controller or local workstation shall be current within the previous 6 seconds.
4. Alarm Response: Maximum time between an alarm event at it being annunciated shall be 45 seconds.
5. Program Execution Frequency: Applications shall be capable of running as often as every 5 seconds; select execution times that are consistent with the process under control and provide optimum comfort and control of setpoints without excess deviation. Controllers shall be able to execute PI and PID control loops at a selectable frequency of at least once per second; with the process value and algorithm output updated at this same frequency.
6. Reporting Accuracy: Control system reporting end-to-end accuracy shall be no less than the following:

    a. Space, Duct, Water Temperatures: Plus/minus 1 deg F.
    b. Outside Air Temperatures: Plus/minus 2 deg F.
    c. Airflow at VAV Terminal: Plus/minus 10% of full scale.
    d. Airflow at Measuring Stations: Plus/minus 5% full scale.
    e. Water Flow: Plus/minus 5% full scale.
    f. Air Pressure in Spaces: Plus/minus 0.01-inches wg.
    g. Air Pressure in Ducts: Plus/minus 0.1-inches wg.
    h. Water Pressure: Plus/minus 2% of full scale.

7. Stability: System shall provide stable and accurate control operation without excessive variation of controlled variables; variation shall in no case be more than 1.5 the reporting accuracy for temperatures, and the same as the reporting accuracy for other variables.

2.3 SYSTEM FEATURES

A. General: Controllers, operator workstation, control components, and accessories shall all be combined to form a complete system providing the sequences of operation/functions specified and having the features specified. System shall monitor and control all functions relating to building environment, utilities, energy usage, and mechanical systems operation. The point monitoring and controlling functions to be performed by the system shall include but not limited to the following capabilities:

1. Digital inputs (e.g. a contact closure of a control device).
2. Analog inputs (varying electrical signal from a control device to a controller).
3. Digital output (e.g. a contact closure by a controller).
4. Analog outputs (varying electrical signal from a controller to a control device).
5. PWM (pulse width modulation) with feedback position indication.

B. Controllers: The system controllers shall directly control all valves, fans, HVAC equipment, dampers, coils, system equipment, and similar devices. All control software shall be implemented in the controllers.

C. Controller Failure: Upon failure of any controller system shall display off-line occurrence for each individual affected point. Provide communication verification to each NAC for each I/O channel. If communication is disrupted, show error count for each attempt to communicate for each registered point per NAC. Operator shall be able to update count and reset to zero.

D. Zone Control: Provide zone-by-zone control of space temperature, usage scheduling, equipment status reporting, and override timers for off-hours usage.

E. Setpoints: Zone temperature setpoints, equipment setpoints, pressure setpoints and all other controlled parameters shall be able to be set by an operator (except where indicated otherwise). System shall have global command ability to override all settings of the same type to the same value. All setpoints shall be operator adjustable (via common English language commands).

F. Password and Security: Access to system shall be by priority password security system to prevent unauthorized use. Minimum of five levels, each assignable to dedicated function keys. Invalid passwords shall lock data base access after three attempts. Operator may select individual security level assignments for each operation and menu selection available.

G. Time Control: System shall have capability for each equipment to have its own independent time schedule; including occupied/unoccupied modes and optimum start cycles. In addition, system shall have capability for each equipment that could be operated on a seasonal basis (e.g. boiler in heating season, chiller in cooling season, associated pumps, de-stratification fans, baseboard heaters, AC units, etc.) to have independent time of year seasonal schedules.

H. Auto-Restart: System shall start automatically on power failure, with a sequence to prevent excessive electrical demand due to all equipment starting at the same time, or undesirable affects due to improper sequencing of equipment. Provide staggered start times for all equipment to prevent more than 10 kW of electrical load from starting at the same time (except where not possible due to individual equipment size exceeding this size). Provide a two minute delay (adjustable) between loads (or as required to allow for a proper re-start).

I. Time Schedule Override: Bypass devices shall send signal to control system indicating requirement for time schedule override operation. The operator shall program the time of override operation at the keyboard from 1 to 15 hours; set initially for 2 hours. Override time remaining to be displayed as part of system graphics; and operator shall be able to alter override time or turn area back to automatic.

J. Run Time: Equipment run time totalization and start/stop totalization of all equipment connected to system; may be trended totalization information, with no required auxiliary equipment.

K. Menu Modification: Operator shall have complete capability to modify displays, menus and menu format headings, data base information, with no required auxiliary equipment.

L. Energy Usage:

1. Peak Demand Recording: The building's electrical demand shall be measured; demand peak in kW and its date and time of occurrence shall be recorded. These values shall be observable by an operator. Provide a KW-hour trend log. Provide demand reading program that matches method and time base used by local utility company to bill for demand so that control system demand readings match the utility readings.
2. Power Recording: Measure building's electrical energy usage; current annual, monthly and daily total building electrical power usage shall be recorded. Provide a KWH trend log.

M. Clock: Real-time clock shall be self-contained and accurately controlled by a quartz crystal. The clock shall be set via the keyboard and may be viewed on the display. A battery standby power supply shall be used to maintain clock operation when primary power fails. When primary power returns, the system shall automatically restart to the appropriate schedules with accurate clock time and require no action from personnel to re-initialize.

N. Disk System:

1. System shall be able to store data base on standard digital disk or load data base from the disk. Operator to be able to program system to automatically dump data base to disk storage system at end of each day for the purpose of updating all point data information and logs.
2. The disk system shall be activated to load or store data to the system controllers on system initialization or as permanent changes as recorded. Disk system shall not be utilized for routine system operation.

O. Alarms:

1. For each analog input point allow operator assignable high and low alarm limits; for each digital input point allow operator assignable alarm.
2. For each analog input alarm and each digital input alarm, allow the following assignable alarm responses:

    a. Provide system output to sound horn or flash remote light as directed on alarm occurrence.
    b. Display English-language description of alarm on system graphics.
    c. Print out alarm description and operator-created alarm message.
    d. Require acknowledgment by operator and print occurrence if directed by owner.
    e. Store previous 300 alarms, with description, time of occurrence, time of acknowledgment, and time of return to normal. Provide for review of alarm history on display and printer.
    f. Provide 100 programmable alarm messages, up to 256 characters each.

3. Operational Alarms:

a. Provide for 200 operational (non-maintenance type) alarms which indicate a safety device alarm or equipment failure alarm (related to an operational issue).
b. Failed Function Alarm: Provide alarm for each equipment that controls heating or cooling: if unit calls for heating (or cooling) but the temperature of the media (i.e. air or water) leaving the equipment does not vary appropriately from the entering temperature of the media; indicating equipment failure. Provide similar alarms for pumps and fans (using proof of flow device pressure) and water heaters.

4. Maintenance Alarms: Provide for 100 maintenance alarms of at least 256 characters. These alarms shall occur to indicate normal maintenance requirements; i.e. upon the arrival of a predetermined calendar date, upon the passage of a specified equipment run time or upon passage of a specified number of equipment start/stops.
5. Train the Owner in the development of all alarms and program the first 25.

P. Logs:

1. Trend Log: Provide trends for all input and output data and the ability to log the data. For each trend log, operator may assign multiple points and an interval sampling rate of 1 minute to 96 hours. Store time segments. Provide for review of data on graphic display and printer. Each trend log shall be able to be assigned individual start/stop times/dates in advance. System shall automatically begin entry into each log as scheduled. Each point in the log shall have 360 entries, all data stored for future retrieval. Trends shall be formatted for ease of reading.
2. Current Alarm Log: An alarm log shall track and display all points currently in alarm.
3. Alarm History Log: Log last 100 alarms as to time of occurrence, time of acknowledgment and time of return to normal. Maintenance alarms shall be separate from operational type alarms.

Q. Scheduling:

1. Time Schedules: The Control System shall provide time clock schedule with at least 100 time schedules. Each schedule to be 8-day type, 6 entries per day. All entries to be in 12 hour AM/PM format. The complete schedule shall be displayed at one time on the operator workstation for easy editing. Each time program shall be able to include on/off, high/low speed or duty cycle commands, or Analog Control Values as applicable for the application. Equipment may be assigned to named schedules, with master revisions to the schedule revising all assigned equipment.
2. Holiday Schedules: A minimum of 24 holiday time schedules shall be available and shall be assigned to any number of available points.
3. Holiday schedule shall display entire year and shall also allow for an interval holiday time, program showing holiday start date to end date (example: December 24 to January 2).
4. Schedules shall provide control of all equipment as indicated in the sequence of operation. Coordinate with Owner for final project schedules.

R. Demand Limiting: Provide a demand limiting program with a hierarchy of equipment loads to be shed. System shall support at least 100 loads and three demand meters.

S. Warm-up Mode: Control System shall have warm-up mode prior to occupied mode on heating to pre-warm building prior to occupancy. Time of beginning warm-up cycle shall be determined by an optimum start/stop program.

T. Optimum Start/Stop: Control System shall have optimum start/stop program to reduce run time of HVAC equipment. Optimum start/stop program shall consider building mass, building temperatures, outdoor air temperatures, and other system factors in determining time of system start-up or shut-down. Program shall record previous warm-up times versus actual warm-up times and shall adjust the program algorithm so that program calculated warm-up time corresponds to actual.

U. System Graphics:

1. Graphics: Provide complete system color graphics with displays of all controlled systems. Graphics shall allow operator capability of constructing additional floor plan drawings, mechanical equipment diagrams, piping diagrams, and similar systems drawings at will, while system is on line. Graphics to be color dynamic, displaying current monitored system values. Graphics shall be menu driven from keyboard keys and from mouse. System shall use English language and acronyms selected to allow operators to use the system without extensive training or without programming backgrounds. Software shall use command strings in a request-response sequence in which the machine prompts the operator for all required information; operator response required shall be the appropriate parameter input data. Software shall contain edit functions and escape modes to eliminate continuous logic loops requiring system reboot to escape. Coordinate with Owners staff to develop all operational data to satisfaction of Owner.
2. Building Plans: Graphics shall include building plans showing locations of all controlled or monitored equipment, areas served, thermostat locations, and significant major control device locations (e.g. CO2 sensors, outside air sensors, etc.).
3. Equipment Summary: Display shall include a summary display of all system measured variables (i.e. all control devices) for equipment, and include (but not be limited to):

    a. Summary status of all controlled or monitored equipment.
    b. Equipment ID number and zone (or area) served.
    c. Zone temperature.
    d. Zone heating and cooling setpoints (adjustable).
    e. Zone mode (heating, cooling, float).
    f. Discharge temperature of HVAC units.
    g. Fan status and commanded value.
    h. Outside air damper position (percentage open).
    i. Alarm status of equipment (contrasting colors).
    j. Heating and cooling valve positions.
    k. Economizer disable setpoint (adjustable).
    l. All safety control devices.

4. Detailed status of mechanical equipment:

a. Equipment identification, location, area served, and description of unit and system.
b. Provide all information required to be sent to GUI for each equipment and any other control loop data indicative of unit operation.
c. Schematic of system with appropriate temperatures, flows, etc. interposed on schematic. Provide schematic for each hydronic system, fan system, steam system, domestic HW, and other systems where extensive measurements are made.
d. Alarm conditions as listed for each equipment under Sequence of Operation portion of specifications. Alarm condition shall be indicated in a contrasting color from normal operation.
e. Unit Run Times:

1) Annual run time.
2) Total life run time.
3) Number of starts/stops.
4) Run time shall be reset by operator (provide operator confirmation that change is desired before making change).

f. Unit and zone time schedules.

5. Time schedules (daily and annual).
6. Operational Alarms.
7. Time and date of last update of listed information.
8. Record of daily outside air temperatures.
9. Record of annual daily building temperatures (selectable from any zone or combination of zones).
10. Trend Logs.
11. Run times of all equipment in one display.
12. All measured control signals (i.e. all points) transmitted to system controllers shall be available for display. Provide organized format and menu for ease of operator display of this information.
13. Building Floor plans indicating location of each thermostat and temperature of space served by that thermostat.
14. Summary of all space temperatures on a single graphic display.
15. AHU Summary: Provide screens with summary listing of all AHU's. List to include unit no., area served (room no. and name), space temp, SA temp, OA damper position, alarm indication, and 2 other variables as selected by Owner.

V. All percentage values on actuators shall indicate percentage open.

W. Provide adjustable date and time stamp on main graphics page.

X. Provide link on main graphics page navigating to pdf files (or equivalent) files showing sequences of operation and as-built drawings.

2.4 CONTROLLERS

A. General: Shall be manufacturer's standard controllers used for commercial DDC systems complying with the system communication protocol specified and allowing the system to provide the specified features and sequence of operation. Controllers shall be listed,

certified, or in some definitive way deemed compliant by an appropriate independent agency that they comply with the system communication protocol being utilized.

B. Types: Type, capacities, arrangement and features shall be Contractor selected to provide an overall system complying with Contract Document requirements.

C. Operating Conditions: Controllers shall be capable of operation over a temperature range of 32 deg F to 130 deg F and a humidity range of 5% to 95% (non-condensing).

D. Network Area Controller (NAC): Shall be modular, multi-tasking, microprocessor based direct digital controller, capable of forming a complete interconnected/communications. Shall provide the interface between the LAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Network management functions for control devices.
7. The NAC must provide all hardware features and accessories as necessary, including ethernet port and battery backup, to provide a complete and operational control system.
8. Provide with flash memory for long term data backup (if battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity).
9. The NAC shall support a standard Web browser access via the Intranet/Internet and provide multiple user access.
10. Controller mounted display with LCD screen with user friendly menu for system access.

E. Terminal Unit Controllers (TUC's): Controller specifically designed for control of individual air handling units, fans, VAV terminal units, and similar type units; controllers shall be microprocessor based and shall contain a non-volatile resident program to allow for proper sequencing of controlled equipment. TUC shall interface to the building control system a multi-drop communications network. An individual controller shall be provided for each piece of unique equipment. Each terminal controller shall be accessible for purposes of control and monitoring from a central or remote operator's terminal as specified herein.

F. Graphic User Interface (GUI): Shall consist of a personal computer, and include a keyboard, modem, printers, monitor, and interface devices for communication to system NAC's and to the system. The system shall allow full interface to entire system for monitoring, equipment control, database management, system performance analysis, trending, programming, management reports, and all other functions necessary to operate and manage the control system. The GUI shall communicate with the system controllers and with other GUI’s. There shall be no limit on the number of simultaneous users accessing the system via their GUI and the internet.

2.5 TEMPERATURE SENSORS

A. Room Temperature Sensors: Solid state electronic type, employing a resistance type output. Factory calibrated to an accuracy of plus/minus 0.5 deg F with a temperature range of 32 to 130 deg F in normally occupied areas and -40 to 140 deg F in other areas, with the following features:

1. Space temperature display.
2. Momentary push button for placing room's system into occupied mode when pressed.
3. Means for adjusting temperature setpoint up or down with setpoint display.

B. Room Temperature Sensor Guards: Lockable, slotted, clear plastic type.

C. Duct Temperature Sensor: Shall be solid state electronic type, employing a resistance type output. Factory calibrated accuracy of plus/minus 0.5 deg F with a temperature range shall be -40 to 160 deg F. The sensor shall include a utility box and gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 5 foot long sensor element installed so as to sense a representative sample of the medium being controlled.

D. Liquid Immersion Temperature Sensor: Shall be solid state electronic type, employing a resistance type output. Factory calibrated accuracy of plus/minus 1 deg F with a temperature range 0 to 250 deg F. Provide brass thermowells and install sensor probe with heat conductive grease. Probe and sensor head shall be removable without breaking fluid seal. Install sensors in top of pipe for horizontal runs and at a positive slope on vertical runs to prevent condensation from flowing to sensor head.

E. Outside Air Temperature Sensor: Solid state electronic type device, for outdoor installation, factory calibrated accuracy of plus/minus 0.5 deg F, with a temperature range of -20 to 180 degrees F. Provide a sun shield and weatherproof assembly.

2.6 ACTUATORS

A. General: Actuators shall use a brushless DC motor controlled by a microprocessor with protection from overload at all angles of rotation. Run time shall be constant, independent of torque. Actuator shall have manual positioning mechanism and direction of rotation control switch and visual position indicator. Housing shall be NEMA rated to suit the conditions at the actuator location.

B. Type: Proportional or two position or floating point type, as required for application. Proportional type shall modulate in response to a 2-10 VDC, or 4 to 20mA control input. Provide with auxiliary switches as required for sequence of operation and to allow for safe operation of items served (and interlocked items), switches shall meet requirements for "double insulation" so an electrical ground is not required.

C. Automatic Closure: Actuator shall spring return upon power interruption, spring return position shall be fail-safe as dictated by freeze, fire or temperature protection requirements; except that actuators required to be the fast operating type may utilize a capacitor discharge for fail-safe closure in lieu of spring (subject to Engineer’s approval).

D. Performance: Actuator power and torque shall be sufficient to match dampers or valves being controlled and allow proper damper and valve operation against system pressures

liable to be encountered. Actuator shall be capable of driving control devices from full closed to full open in less than 90 seconds (unless indicated otherwise) and where fast operating type are required (i.e. where interlocked with equipment operation). Where actuators serve valves or dampers directly serving equipment (e.g. boiler water flow control valves) or are interlocked with equipment operation (e.g. make-up air equipment dampers) verify required operating time of actuator with equipment manufacturers and timing of other system components to allow for proper system operation without nuisance shutdowns of equipment or creating undesirable effects due to improper actuator response time.

E. Accessories: Units shall be complete with all brackets, and hardware required for mounting and to allow for the proper control of the regulated damper or valve.

2.7 ACCESSORIES

A. Wiring and Conduit:

1. Basic Materials: As specified in Division 26.
2. Power Wiring: 18 AWG minimum and rated for 300 VAC service. Wiring for circuits greater than 24 V shall be as specified in Division 26.
3. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.
4. Life Safety Applications: Wiring that performs code required life safety control (e.g. shutdown of equipment), control of engineered smoke systems, fire alarm interface and similar functions shall comply with code and NFPA standards for fire alarm system wiring and the specific application.

B. Labels:

1. General: Shall comply with Section 200500.
2. Control Devices: Labels on control devices shall use the same designation that appears on the control shop drawings and an indication as to purpose; except that devices in finished rooms shall be labeled as to the generic item controlled for better user understanding (i.e. ‘Room Exhaust Fan”, “Hood Fan”).
3. Wiring: Wiring labels shall be the self-laminating or heat shrink type with numbering, lettering, or an alpha-numeric identifier indicating the wire signal/power purpose and matching the designation that is used on the control drawings

C. Control Cabinets: Wall mounted, NEMA rated construction, type and rating to suit location environment, UL listed, minimum 14 gauge sheet metal, hinged front door with latch. Size as required to house controls. Controls/devices shall be logically assembled in cabinet, with all devices and cabinet labeled.

D. Relays/Contactors: Shall be the single coil electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be doubled break silver to silver type protected by arching contact where necessary. Number of contacts and rating shall be selected for the

application intended. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage. Relays shall have mechanical switching to allow manual operation of relay and LED light to indicate the energized state.

E. Thermowells: See Section 200900.

F. Miscellaneous Sensors/Transmitters/Switches/Transformers: Shall be manufacturer's standard, designed for application in commercial building HVAC control systems, compatible with other components so as to provide sequence of operation specified.

2.8 SWITCHES

A. Current Monitoring Switches: Electric current sensing device with integral switching contacts. Device shall sense current (amperage) through the conductor the device is applied to and activate switch action (to make and break contacts) once current reaches a preset value. Device shall be able to be clamped around conductor, and be removable. Switch rating, size, switching current, and type selected by Contractor to suit application and provide the required function. Provide type specifically rated for the motor and load type being applied to.

B. Air Flow Switches: General Purpose utilizing differential air pressure, SPDT snap-acting contacts, adjustable 0.1 in. W.C. to 2.0 in. (minimum), neoprene diaphragm, all aluminum construction.

C. Bypass Switch: Shall be momentary contact type push button. Install in standard wall box with stainless steel cover.

D. Wall On/Off Switch: Standard wall box type switch, single pole, with illuminated switch for when controlled item is on. Provide with stainless steel wall plate, labeled as to function.

E. Interval Timer - Push Button Type: Momentary contact type illuminated pushbutton with metal operator, amber LED light, and stainless steel cover plate. Sized to suit standard electrical wall junction box. Label as to function.

2.9 PRESSURE AND VELOCITY SENSOR/TRANSMITTERS

A. Air Velocity Transmitter: Shall be a duct mounted instrument that measures the difference between total pressure and static pressure to get velocity pressure. Measurement shall be by a pitot tube located in the moving air stream or by a duct mounted air flow measuring station. The transmitter shall be an industrial quality device that produces a linear output directly proportional to the input utilizing an integral square root extractor. The air velocity span shall be a segment of the range between 200 and 5000 feet per minute.

B. Air Pressure Transmitter: Shall universally measure very low static or differential pressure using a variable capacitance technique. Static pressure shall measure in ranges from 0 to 10 inches water column. Differential air pressure shall have a range of 0 to +/- 0.5 inches. Transmitter accuracy, including non-linearity, hysteresis and non-

repeatability shall be within 1% of full scale. Provide zero and span adjustments for a proportional output of 4-20ma.

C. Air Differential Pressure Sensor: Electronic transducer, incorporating linear variable differential transformer type sensing element with two-wire 0-10 Vdc transmitter. Accuracy shall be +/- 2% of full scale. Submit chosen spans for review.

D. Liquid Differential Pressure Sensor: Single pole, single throw switch, bellows type, with adjustable range, suitable for application intended.

2.10 LOCAL OPERATOR'S WORKSTATION

A. General: Desktop computer, with keyboard, software, modem, printers, monitor, and interface devices for system communication and communication with the system. Operator station shall provide full interface to entire system for monitoring, equipment control, database management, system performance analysis and management reports. The operator terminal shall communicate with the system controllers and with other operator terminals.

B. Computer: Shall have following minimum requirements:

1. OptiPlex 9010, Core i5-3470 quad core 3.2 GHz/6MB.
2. 8GB, 1600 MHz DDR3, 2DIMM.
3. Integrated Video Card, Intel 4500.
4. 500 GB SATA Hard Drive, 6 Gb/s with 16 MB with Data Burst Cache.
5. Windows 7 with XP mode.
6. 16x DVD +/- RW SAYA.
7. OptiPlex Resource CD.
8. Next Business Day Parts and Labor On-Site Response, Initial Year.
9. Next Business Day Parts and Labor On-Site Response, 2YR Extended.
10. 20.0 Inch Monitor with graphic card.
11. Keyboard and Mouse: The system shall be fully menu-driven. All system titles, prompts, and instructions to be in English language and user friendly. All entries to be in natural units, i.e., a setpoint value shall be entered in its actual control value, such as 74°F. All operator commands, changes, and data displays identified in the sequence of operation shall be available and executable at single operator’s terminal within ten (10) seconds.
12. Four USB ports.
13. Ethernet Card: Shall be 10/100 Mbit card.
14. Accessories: Provide all serial expansion ports for all interface devices and all required cables.

C. Printer: Inkjet color printer terminal, complete with cables (as required for connection to operator terminal). Provide with two full sets of all required ink cartridges.

D. UPS: Standalone UPS to serve local operator's workstation.

E. Software: Provide all necessary software, fully programmed and customized to provide complete system features and functions specified. Software shall support Dynamic Data Exchange (DDE). Provide installable copies of all software required for proper operation

of the EMS and the User Interface. This includes the EMS software, User Interface Operating System, and any required drivers.

2.11 CONTROL DAMPERS

A. Type: Low leakage control dampers, parallel blade or opposed blade type as selected by Division 25 contractor to best suit application (unless a specific type is indicated).

B. Leakage: Class 1A leakage rated in accordance with AMCA 500-D.

C. Construction: Construct of galvanized steel, except where installed in ducts of stainless steel or aluminum construction or handling corrosive air, shall be of stainless steel or aluminum construction (to match duct material) or have corrosion resistant coating. All materials in contact with the airstream shall be suitable for the conditions without deterioration. Frame shall be minimum 16 gauge with reinforced corners.

D. Blades: One-piece airfoil shape, not exceeding 6 inches in width, minimum 16 gauge, with neoprene, extruded vinyl or butyl rubber edge seals and flexible metal jamb seals; linkage interconnecting all blades and actuator axle.

E. Bearings: Nylon, molded synthetic, or oil impregnated sintered metal bearings (or other materials as conditions require).

2.12 CARBON DIOXIDE SENSOR – WALL

A. Type: Wall mounted non-dispersive infrared (NDIR) type carbon dioxide sensor. Vaisala GMW45 (or approved).

B. Performance: Measuring range 0 to 2000 ppm CO2, accuracy plus or minus 3% of reading (including repeatability and calibration uncertainties), non-linearity plus or minus 1% of full scale. Shall have long term stability of 5 years (i.e. no more than 5% of full scale error after 5 year operation).

C. Housing: ABS molded plastic housing, white, with vent openings.

D. Output: Shall provide 4 to 20mA, 0 to 20 mA, and 0 to 10V outputs, selectable by output selection jumpers.

E. Tools: Provide project with hand held carbon dioxide meter (Vaisala GM 70) and complete calibration kit, including test gas, software, connection accessories and instructions to allow for field calibration of all project CO2 sensors.

2.13 VARIABLE FREQUENCY DRIVES

A. Type: Adjustable frequency and voltage variable speed controller, pulse width modulated type.

B. Controller: Shall be housed in a NEMA 1 (or better) enclosure, and shall provide 6 to 60 Hz adjustable torque output. Standard Features:

1. Start-stop speed selection.
2. Manual speed potentiometer.

3. Input fuses.
4. Insensitive to incoming power phase sequence.
5. Adjustable volts/Hertz.
6. Output frequency stabilized to + 0.5% of set speed for +10% to -5% change in line voltage of 15 degrees C change in ambient temperature.
7. Three-phase output voltage regulated to + 1% of rated voltage with +10% to -5% variations in plant power.
8. Standard off-the-shelf, NEMA B and synchronous motors (3600, 1800, 1200 rpm) usable without derating controller.
9. Automatic shutoff under output short circuit conditions or when load current exceeds150% of maximum output amps (RMS).
10. Input fuses.
11. Line transient protection to prevent power line transients from harming the controller.
12. Relay contact to provide external signal for alarm and run condition.*
13. Monitor lamps (or LCD display) indicating: power on, zero speed, enabled, unit failure (with type indicated).
14. Hand-Off-Auto switch.
15. Auto restart after power outage.
16. Isolated Process control Follower - accepts 0 to 5 mA, 1 to 5 mA, 4 to 20 mA, 10 to 50 mA, 0 to 10 V D-C or 25 to 250 V D-C signal.
17. Input Disconnect (meeting NEC requirements for unit power disconnect).
18. Output Contactor - for positive motor disconnect.
19. Output Overloads - using individual phase bimetallic thermal sensors.
20. Ammeter - ampere scale depending upon drive rating.*
21. Voltmeter -0 to 500 volt (460 volt drives); 0 to 750 volts (575 volt drives).*
22. Frequency Meter - 0 to 120 Hz scale.
23. Manual Bypass - To switch the motor to or from the controller to the line.*

* Not required on units serving fans under 2 hp.

C. VFD shall be for use with specified equipment. Unit shall accept appropriate control signal and provide for variable speed operation of unit served.

D. System shall be fully compatible with motors furnished, and shall be free of audible noise exceeding an NC of 45 in any octave band.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide all computer software and hardware, operator input/output devices, sensors, relays, switches, dampers, actuators, conduit, tubing, wiring, motor starters, transformers, control cabinets, power panel circuit breakers, system design, and all other components required to provide a complete control system with the system features and sequence of operation specified. Select control components with proper characteristics to suit the application, meet specified system performance, provide specified system features, and provide the specified sequence of operation.

B. Room Sensors: Room sensors (i.e. thermostats) shall be mounted at 48" above finished floor, unless indicated otherwise. Thermostats shall control the equipment which affects the temperature serving the space the thermostat is located in, unless indicated otherwise.

Not all room sensors are shown on the drawings and those shown are preliminary only. Contractor shall indicate all final room sensor locations on submittal drawings. Contractor is responsible for coordinating locations to avoid chalkboards, tack boards and other interferences.

C. Electrical Power and Wiring:

1. General: All work shall comply with code and Division 26 requirements. Run conduit and wiring in neat lines, parallel with building construction and coordinated with other trades. Use wire type and size as required by code and recommended by component manufacturers and to suit the application conditions.
2. Conduit: All wiring shall be installed in conduit and in accordance with Division 26 section of these specifications, except that low voltage wiring within ceiling plenum spaces and in mechanical mezzanine areas may be ran without conduit provided that plenum rated cable is used. Install all conduit and wiring parallel to building lines.
3. Electrical Power:

    a. Scope: It is the responsibility of the Division 25 Contractor to provide power for all control devices requiring electrical power. Coordinate with the Division 26 Contractor to confirm which panels and circuits are to be utilized. Provide all electrical wiring, conduit, junction boxes, circuit breakers, grounding, panel circuit breakers (of proper size/type), transformers, enclosures and all other components as needed to power all control devices.in accordance with code and Division 26 requirements.
    b. Sources: Power for control devices shall be obtained from electrical panels and not from power serving the equipment (unless noted otherwise or the Engineer gives approval). Utilize panels located closest to the items served to the greatest extent possible. Where the building has a generator, equipment served by the generator shall also have their control power (i.e. power to control devices which allow the item to be controlled and monitored) shall also be served by the generator (this is in addition to any required UPS').
    c. Uninterruptible Power Supplies (UPS'): All system JACE's, network area controllers, designated system work stations and similar high level integration components or user interface components shall obtain their power from UPS'.

4. Service Loop: Provide minimum of 6" extra wiring at all wiring terminations for ease of future maintenance/servicing. Such extra wiring shall be neatly coiled/bundled to allow for uncoiling when the connected equipment is serviced.
5. Miscellaneous Control Wiring: Provide all necessary control wiring between equipment to allow for proper operation. This includes AC units, chillers, boilers, kitchen hoods, and items furnished by others or under other Sections of the specifications.

D. Labeling: All control components, except regular room thermostats, shall be labeled. All control wiring shall be labeled except where color coded wiring is used and the control shop drawings clearly identifier wiring for each color and it is fully consistent through-out the entire project. Submit list of proposed labeling prior to installing.

E. Complete Functions: Provide complete system totally programmed to provide all specified functions, including but not limited to:

1. Time and Holiday Schedules.
2. Alarm Limits.
3. Optimum Start of Each Zone.
4. Dynamic Graphic of Each Distinct Floor Area; include graphic key to allow changes in graphic display.
5. Dynamic Graphic of Each Mechanical System; include graphic key to allow changes in graphic display.
6. Summary of All Zone Temperatures.
7. Summary of Data for Each Zone.
8. All Displays Specified in Sequence of Operation.
9. Master Menu and Graphics as requested by the Owner.
10. All Controller Setpoints and Operational Values Required.
11. Demand Limiting.
12. Optimum Start/Stop and Warm-up.

F. Electrical Energy Metering: Provide all necessary wiring, components, software, and accessories to meter building electrical energy usage. Coordinate with other trades for installation of meters, CT's, and similar devices in systems. Unless clearly indicated as being provided by Division 26, assume all such devices are by this Section.

G. Electrical Phase Loss: Provide all necessary wiring, components, software, and accessories to monitor building electrical power quality and 3-phase power; initiate shutdown of 3-phase powered mechanical equipment on loss of a phase.

H. On/Off Status Indication: All devices which indicate on/off status to GUI, shall have this on/off status manually or automatically controlled from GUI, and shall have positive proof of on or off by differential pressure switch or other applicable device.

I. Time Clock Bypass Switch: Provide integral with each room sensor. Provide additional ones as indicated on the plans and where room sensor is not accessible. Bypass switch shall serve unit that supplies space in which bypass switch is located. Activation of by pass switch shall put unit(s) bypassed into the occupied mode as well as all equipment interlocked with the bypassed units. bypass shall be for 2 hours, but shall be adjustable in 30 minute increments at the GUI.

J. OA Sensors: Provide at least two OA sensors for this project, with display at the GUI; use average of two for control purposes. Provide logic to allow disuse of "Bad" OA sensor and indicate alarm.

K. TUC: To simplify controls and mechanical service and trouble-shooting, the TUC shall be mounted inside a waterproof cabinet on the side of rooftop units. This shall allow all controls maintenance and trouble-shooting to be made while at the unit location.

L. Programming: Provide complete system totally programmed to provide all specified sequences, monitoring data, communications and features.

3.2 MONITORING DATA

A. General: Monitoring information shall be provided at graphic user interface. Provide all necessary controls/devices to provide the data indicated. Monitoring data listed is not a "points list" but is a list of items that shall be monitored and is in addition to data (or "points") required by the sequence of operation and other specification requirements. A complete "points list" shall be compiled by the Division 25 Contractor based on all system requirements and sequence.

B. Exhaust Fans:

1. Fan on/off status.
2. Fan commanded status (on/off).
3. Space temperature (for fans controlled by thermostat).
4. Fan failure alarm; (i.e. not "proven" on when commanded on).
5. VFD commanded percentage (for units with VFD's).
6. VFD Alarms.

C. Air Handling Units (DOAS and MAU units):

1. Unit commanded mode (heating/cooling).
2. Supply air temperature off unit.
3. Return air temperature to the unit.
4. Outside air temperature downstream of heat exchanger.
5. Exhaust air temperature downstream of heat exchanger.
6. Override status.
7. Outside air cfm.
8. Heat pump compressor status.
9. Electric heat status.
10. Supply Fan status.
11. Exhaust Fan status.
12. Fan commanded position (on/off).
13. Damper commanded positions.
14. Alarm/trouble conditions, shall include as a minimum: freezestat alarm; fan not "proven" on when should be on; heat failure alarm - SA temp not warmer than ma and unit is in heating; cooling failure alarm - SA not cooler than ma and unit is in cooling; "false" cooling or heating call - i.e. Unit calls for heating when OA temperature is above 70 deg F, unit calls for cooling and OA temperature is below 30deg F).
15. VFD commanded percentage (for units with VFD's).
16. VFD Alarms.

D. Water Heater:

1. Leaving HW temperature (at each tank and where headered together).
2. HWC temperature (at HWC pump).
3. High tank temperature alarm (10 degrees above scheduled tank temperature).

E. Circulating Pumps:

1. On/Off status (by differential pressure device or flow switch).
2. Failure alarm (i.e. not "proven" on when commanded on).

F. Heat Pump Indoor Units:

1. Occupied/Unoccupied status.
2. Space temperature.
3. Space temperature setpoint.
4. Mode of operation (Heating/Cooling).
5. Alarms.

G. Heat Pump Outdoor Units:

1. Occupied/Unoccupied status.
2. Compressor status for each compressor.
3. Mode of operation (Heating/Cooling).
4. Alarms.

H. Electric Heaters:

1. On/Off Status.
2. Space temperature.
3. Space temperature setpoint.

I. Miscellaneous:

1. Outside Air Temperature (two locations).
2. Elec/Telecom/Equipment Room Temperature. Indicate alarm if above setpoint.
3. Fire Alarm Status.
4. Cooler/Freezer Temperatures. Indicate alarm if above setpoint.
5. Haz'd Buffer Hood Alarms (Two alarm contacts).
6. Elevator Machine Room Temperature.
7. Fire/Smoke Damper Status (open/closed)

J. Energy Metering:

1. ~~Building overall electrical consumption and demand.~~ *Building overall energy consumption and demand (utilizing Division 26 meters; see Electrical Drawings).* (Addendum 2)

K. Water Metering:

1. Building overall water consumption.

3.3 START-UP

A. Calibration and Commissioning: As each part of the systems become operational, this Contractor shall calibrate all sensing and readout devices and shall test and observe the operation of each and every air moving and/or heating unit and shall adjust all controls so that the items function according to the intent of the specifications. The control contractor shall commission all controls prior to the work of Section 20 08 00 being done. This commissioning work shall include a point-to-point check of all devices, check of sequences, check of proper wiring, and documentation substantiating the work.

B. Report/Statement: After making all necessary system testing and adjusting, the Contractor shall submit a report to the Engineer indicating all testing/adjustment work done and comment on how system is operating. Such report shall be signed by the individual directly responsible for supervision of the installation of the control system. When the Contractor feels that the system is complete and ready for review by the Engineer, Contractor shall submit a written statement (signed by same individuals as for report) stating that the system is in compliance with the project requirements and ready for review.

C. Owner Instruction: See Section 200500.

D. Start-up Trend Logs: The Contractor shall submit to and review with the Engineer daily for a period of four weeks after substantial completion a hard copy log of the following:

1. Five Owner selected room temperature values at 15 minute intervals.
2. Outside air temperature values at 15 minute intervals.

E. Warranty Trend Logs: Two months after Owner acceptance of the work, the Contractor shall submit to and review with the Engineer a single tabulated 30 day hard copy printout of the systems historical data containing the following information:

1. Date.
2. Hour by hour zone temperature, for five Owner selected rooms.
3. Hour by hour OA temperature.

F. Documentation: Contractor shall provide a hard copy documentation of the software application program for each digital controller (TUC, NAC). Documentation provided shall include block software flow chart showing the interconnection between each of the control algorithms and sequences for systems utilizing program listings. A program listing shall be printed onto the same blueprint, along with the program flow chart, and description of the sequence of operation. A hard copy of this document shall be stored and maintained in each stand-alone digital controller panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

3.4 COMMISSIONING

A. The Energy Management and Control System (EMCS) is to be commissioned per Section 019113 – General Commissioning Requirements and Section 250800 – Commissioning of HVAC. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

B. The EMCS contractor shall provide the technician responsible for the EMCS installation to attend a Controls Integration Meeting (CIM). The CIM shall be conducted after the EMCS submittal and the Variable Refrigerant Flow Zoning (VRFZ) control submittal are complete and the CA has reviewed the submittals. The meeting is to be conducted prior to finalizing the functional test procedures and shall be attended by the Commissioning Authority, the EMCS controls contractor, the VRFZ control supplier and a representative of the Owner's maintenance group at a minimum. The CIM shall include, but not be limited to, the following topics:

1. Sequence of Operations
2. Alarm Points List
3. Trend Points List
4. Displayed/Adjustable Point List
5. Graphical Interface
6. Integration with packaged equipment
7. Point-to-Point Checkout and Commissioning of Existing Equipment
8. Method of Conducting Cx Functional Testing

END OF SECTION 255000

SECTION 259000 - INTEGRATED AUTOMATION CONTROL SEQUENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and Division 01 Specification Sections, apply to this Section.

B. Requirements of Section 200500 apply to this Section.

1.2 WORK INCLUDED

A. Control System Design.

B. Control System Sequence of Operation.

1.3 SUBMITTALS

A. General: Comply with Section 200500.

B. Sequences: Submit complete description of sequence of operation for all systems. Sequence submitted shall not be a direct copy of the sequence specified herein, but shall be written to reflect the actual control sequence provided and to more closely match the actual programming used.

C. Programming: Submit copy of system programming logic. Submit programming manuals to allow interpretation and review of programming symbols and logic modules.

1.4 GENERAL REQUIREMENTS

A. Modifications: Software, graphics, and sequences shall be revised and updated as necessary to reflect Owner or Engineer desired changes. Contractor to include in bid no less than 16 hours of control technician's/programmer's time to accomplish the required system modifications.

B. Sequence Terminology: Wherever the control sequences refer to an article, device or piece of equipment in the singular number, such reference shall mean to include as many of such articles, devices, or equipment as are shown on the plans, required for the sequence, or required to complete the installation. Wherever the control sequence refers to an operating stage in the singular number, such reference shall mean to include as many stages as are specified for the equipment and shall mean analog (i.e. proportional) type control where specified for the equipment (reference drawings and equipment specifications).

PART 2 - PRODUCTS

NOT USED

PART 3 - INSTALLATION

3.1 GENERAL

A. DDC: All sequences shall be provided by the DDC control system, unless specifically noted otherwise. Split system AC units shall be controlled by their own integral controls. Controls shall be arranged such that no equipment provided safeties or code required devices are bypassed.

B. Additional Sequences: See Section 255000 for system requirements that relate to control sequences and drawings for additional control sequences.

C. Complete System: Provide all devices as required to allow for automatic control as specified herein. Provide complete system with sequences of operation as specified herein. Provide all control interconnections between indoor and outdoor units, and on equipment.

D. Sequences: All sequences shall be provided by the DDC control system, unless specifically noted otherwise. Control sequences which involve maintaining a setpoint in response to variable conditions shall use proportional-integral (PI) or proportional-integral-derivative (PID) control.

E. Time Control:

1. Control system shall provide time schedules for occupied/unoccupied mode switching for all items having occupied/unoccupied modes, and for all items indicted as having time schedule control.
2. Provide independent occupied/unoccupied mode schedules and optimum start (i.e. warm-up) cycles for each HVAC unit, all fans indicated as having time control, and all mechanical equipment.
3. Provide seasonal (i.e. time of year) control for all mechanical equipment.
4. Provide a single Holiday Schedule or Master Holiday schedule for logical equipment groups as directed by the owner at submittal time and during the owner training. At the end of the warranty period readjust the grouping of equipment as directed by the owner.

F. Adjustability: All setpoints and differentials shall be adjustable. Setpoints indicated are initial settings.

G. Hand-Off-Auto Control: Provide all control devices and connections to allow Hand-Off-Auto (HOA) control of all controlled items; where unit starters or VFD's provide HOA control no additional controls are required, but controls shall be arranged to allow for HOA controls. Where equipment or control devices are interlocked, the Hand mode shall provide the same sequence independent of control logic (i.e. if an exhaust fan is put in hand mode, controls shall be installed to open the associate damper).

H. Warm-up Control: Control system optimum-start controls shall provide warm-up switching for all items indicated as having a warm-up cycle.

I. Various thermostats, motorized dampers, and other devices are not shown on the drawings but are required per the sequence of operation specified. Coordinate with Engineer for location of all such devices prior to installing. Indicate proposed locations on submittals.

J. Average Thermostats: Where average thermostats are indicated on plans combine and

average temperature requirements from each sensor and use average requirements to control unit. Provide means (at GUI, in single screen command) the ability to select between using of either thermostat.

K. Confirm Settings: Confirm with Owner all setpoints, all time schedules, and all other adjustable programming parameters before substantial completion.

L. Demand Response Setpoint: Provide ability via toggle at system graphics (or binary input to the system) for global space thermostat setpoint adjustments of: 2 deg F increase of cooling setpoints; 2 deg F decrease of heating setpoints.

M. Alarms: Provide alarms for the following:

1. Status of item does not equal commanded status (where proof of status is monitored, e.g. supply fan not proven on when commanded on).
2. Equipment in alarm (where equipment alarm state is monitored).
3. System response is not consistent with commanded response (e.g. air handling unit SA temperature is not less than MA temperature and unit is commanded to cooling).
4. Freezestat alarm.
5. Safety device alarm.
6. Space temperature in alarm range (15 deg F or more above cooling setpoint; 15 deg F or more below heating setpoint).
7. Sensor failure (out of range).

N. Fire/Smoke Shutdown:

1. Smoke Detector: Provide necessary conduit, wiring, and accessories to shutdown each unit upon activation of that unit's smoke detectors. Connections shall be hardwired; independent of any control system logic, so that failure of control system or loss of control system will in no way prevent the shutdown of each unit. In addition to shutting down the unit with the alarmed smoke detector, all equipment interlocked or served by that unit shall be off. Other units shall also shut-off as required to avoid building pressure differentials and similar undesirable effects. Upon reset of alarmed device, system shall automatically return to normal, provide time delay start of all equipment 2 KW and greater (already controlled by EMCS), to minimize electrical surges.
2. Fire Alarm System: Shut-down all air handling equipment covered by when the building fire alarm system goes into alarm. Contacts in the fire alarm system are available for this purpose. Such shut-down shall include all equipment in the alarmed zone, all equipment outside the alarmed zone but served by equipment in the alarmed zone, all equipment serving the alarmed zone and any other units as necessary to avoid undesirable effects such as excessive building pressurization, air movement from one zone to another, etc. This added shut-down may be accomplished by use of control logic and is not required to be hardwired but shall be of a fail-safe nature so as to provide the necessary shut-down in case of control failure. Reset shall be same as that specified for hard-wired unit smoke-detector shut-down.

O. Electrical Phase Loss: Initiate shutdown of 3-phase powered mechanical equipment on loss of a phase.

P. Warm-Up Cycle: Warm-up cycle shall be a programmed or times cycle separate from the building occupied cycle and shall be adjustable.

3.2 HEAT PUMPS – SEQUENCE OF OPERATION

A. See Section 238127.

B. Provide custom graphics similar in layout and architecture as graphics for other equipment specified here using points available from VRF System BACNet interface. (Addendum 2)

3.3 KITCHEN HOOD MAKE-UP AIR UNIT

A. General:

1. Control unit's heating in proper sequence to provide a supply air temperature to meet space setpoint except discharge temperature shall not exceed 60 deg F.
2. Controls shall evaluate the supply air temperature deviation from setpoint and rate of this deviation to determine the heating operation so as to satisfy the supply air setpoint.
3. Provide control interconnections from control panel to fans and MAU.

B. Operation:

1. Fan: Fan VFD shall be interlocked to Automated Hood Control Panel (see FS drawings) to ramp fan up and down via an input from the Automated Hood Control Panel.
2. Heater: Heater SCR controls shall ramp up or down to meet space setpoint.

3.4 EXHAUST AND TRANSFER FANS

A. General: See "Control" column on Fan Schedule for which of the following control method is required. See notes on plans for control of fans not listed below and other requirements.

B. Wall Switch: Fan shall be controlled by on/off wall switch. Fan shall be on when switch is in the on position, and be off otherwise.

C. Time Schedule: Fan shall run from time schedule.

D. Thermostat: Fan shall run when temperature rises above setpoint, and shall be off once space temperature falls 2 deg. F or more below setpoint.

E. Automated Hood Control: Fans and MAU shall be interlocked with BACNet compatible Automate Hood Control Panel (see FS drawings). Provide control interconnections from control panel to fans and MAU.

F. Equipment Interlock: Interlock fan to run when equipment unit is interlocked with is on.

3.5 ELECTRIC HEATERS – THERMOSTAT CONTROL

A. Occupied Mode: Heater shall be on once space temperature has fallen 2 deg F or more

below setpoint, and shall be off once temperature has risen 1 deg F or more above setpoint.

B. Unoccupied Mode: Heater shall be off.

C. Warm-Up Mode: Heater shall be on.

3.6 ELECTRIC HEATERS – INTERVAL TIMER CONTROL

A. General: Heater shall be on when activated by 0-30 minute interval timer; otherwise heater shall be off.

3.7 HVLS PADDLE FANS

A. General: Fans shall have local on/off/speed control and automatic control, with the EMCS controlling all fan operation. See paragraph 3.1 for other sequence requirements such as Fire Alarm Shutdown.

B. Occupied Mode:

1. Normal: Fan shall run continuously in low speed unless a Destratification condition or a High Temperature condition occurs; or local control is initiated.
2. Destratification: When ceiling temperature exceeds space temperature by 7 deg F (adjustable) or more, fan operates in high speed to de-stratify air.
3. High Temperature: When space temperature exceeds setpoint by 3 deg F or more fan operates in high speed until space reaches setpoint. Provide minimum 10 minute run time and minimum 5 minute delay between fan starts (or speed changes).
4. Local Control: Room speed control (slide or push-button up/down type) shall provide input to the EMCS for local speed control (when adjusted), shall stop fan operation when set at its lowest position, and shall initiate fan operation upon being adjusted (if fan was off, or vary speed if fan was on). Fan shall remain in EMCS selected speed until speed control is adjusted, and once adjusted shall remain in the local adjusted mode for 4 hours.

C. Warm-up Mode:

1. Normal: Fans shall be on in high speed, until space has warmed up to occupied mode setpoint.
2. Local Control: Same as specified for Occupied Mode.

D. Unoccupied Mode:

1. Normal: Fan shall be off.
2. Local Control: Same as specified for Occupied Mode.

3.8 DOMESTIC WATER HEATERS

A. High Temperature Shutdown: Provide water heaters with hard wired high temperature shutdown safety, which will stop water heater operation and alarm at EMCS; set initially for 10 degrees F above water heater setpoint.

B. Emergency Shutdown: Connect water heater controls through wall mounted emergency shutdown switches to completely stop unit operation when switch is pressed.

3.9 DOMESTIC HW RECIRCULATION PUMPS

A. General: Pump shall be enabled to operate by time clock schedule. When enabled, pump shall be controlled in conjunction with a sensor in the hot water recirculation line. When HWC falls to 5 degrees F below setpoint, the pump shall run; when temperature returns to setpoint, pump shall be off. Setpoint and differential shall be adjustable. Initial setpoint shall be 5 degrees less than domestic hot water setting for system used on.

3.10 ~~DOAS UNITS~~ *DOAS Units: DOAS-K and DOAS-P* (Addendum 1)

A. Occupied mode: Supply and exhaust fans are on. Outdoor air and exhaust dampers shall be 100% open. Outside air bypass damper shall be 100% closed.

B. Occupied mode cooling: If outside air temperature downstream of heat exchanger is above 75 deg F heat pump cooling shall be enabled to maintain discharge air temperature setpoint.

C. Occupied mode heating: If outside air temperature downstream of heat exchanger is less than 70 deg F heat pump heat shall be activated to maintain discharge air temperature setpoint.

D. Unoccupied mode: Unit shall be off.

E. Occupancy override mode: When 3 or more (adjustable) VRF indoor units within the DOA zone have been activated outside of normal occupancy, the DOAS unit shall revert to the occupied period for 2-hours (adjustable).

F. Mode control: Units' mode of operation shall be determined by central time clock and by the Occupancy Override Mode.

3.11 MISCELLANEOUS

A. Provide space temperature sensor in electrical, equipment, and telecom rooms.

B. Miscellaneous Dampers/Devices: See plans for other dampers and devices requiring control. Provide control indicated. Where control is not indicated provide standard sequence typical for such devices in similar projects/applications.

C. Provide space temperature sensor in each walk-in cooler and freezer. Provide high temperature alarm.

D. Exterior Lighting Control: Provide separate time schedules to allow for control of exterior lighting. Connect to Division 26 provided relays for this purpose at Division 26 BACNet-compatible lighting panel. Provide Photocell to lockout selected zones when Outside ambient light level exceeds setpoint (adjustable). See Electrical Drawings for number of zones.

E. AC Units: Connect thermostat (furnished with unit) to indoor section, provide control

interconnections from indoor section to outdoor section.

E. Freezer/Cooler: Provide output to security monitoring panel upon high temperature alarm. Coordinate with Owner's representative for location of security panel. (Addendum 1)

3.12 DOAS-W

A. Occupied mode: Supply and exhaust fans are on. Outdoor air and exhaust dampers shall be 100% open. Outside air bypass damper shall be 100% closed.

B. Occupied mode cooling: Economizer cooling shall be the first stage of cooling; if outside air temperature is above 55 deg F and is lower than space temperature and space temperature is above setpoint, outside air bypass damper shall modulate so that outside air bypasses heat recovery coil. Heat pump cooling shall be the second stage of cooling. When outside air temperature exceeds space temperature, bypass dampers shall close.

C. Occupied mode heating: If outside air temperature downstream of heat exchanger is less than 70 deg F heat pump heat shall be activated to maintain discharge air temperature setpoint.

D. Unoccupied mode: Unit shall be off.

E. Occupancy override mode: When 3 or more (adjustable) VRF indoor units within the DOA zone have been activated outside of normal occupancy, the DOAS unit shall revert to the occupied period for 2-hours (adjustable).

F. Mode control: Units' mode of operation shall be determined by central time clock and by the Occupancy Override Mode.

3.13 DOAS-K2

A. Occupied mode: Supply and exhaust fans are on. Outdoor air dampers shall be 100% open. Exhaust air damper shall modulate to maintain space pressurization. Outside air bypass damper shall be 100% closed.

B. Occupied mode cooling: If outside air temperature downstream of heat exchanger is above 75 deg F heat pump cooling shall be enabled to maintain discharge air temperature setpoint.

C. Occupied mode heating: If outside air temperature downstream of heat exchanger is less than 70 deg F heat pump heat shall be activated to maintain discharge air temperature setpoint.

D. Unoccupied mode: Unit shall be off.

E. Occupancy override mode: When 3 or more (adjustable) VRF indoor units within the DOA zone have been activated outside of normal occupancy, the DOAS unit shall revert to the occupied period for 2-hours (adjustable).

F. Mode control: Units' mode of operation shall be determined by central time clock and

by the Occupancy Override Mode. (Addendum 1)

END OF SECTION 259000

SECTION 260500 – COMMON WORK RESULTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes general electrical requirements for all Division 26 work and is supplemental and in addition to the requirements of Division 01.

B. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

C. General Requirements: Conform to Contract Documents. This section is supplemental and in addition to requirements of Division 01.

D. Conditions and Requirements: Conditions and requirements of the General Provisions, Supplemental General provisions and Special Provisions are hereby made a part of the Electrical Division of this Specification. If requirements disagree, the more stringent requirement will become the contractual obligation.

E. Provide a complete working installation with all equipment called for in proper operating condition. Documents do not undertake to show or list every item to be provided. When an item not shown or specified is clearly necessary for proper operation of equipment shown or specified, provide an item which will allow the system to function at no increase in Contract Sum.

F. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

G. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both.

1.2 DEFINITIONS

A. Definitions of all terms shall be in accordance with applicable definitions of:

1.	AIA	-	American Institute of Architects
2.	IEEE	-	Institute of Electrical and Electronic Engineers
3.	IES	-	Illuminating Engineering Society
4.	NEMA	-	National Electrical Manufacturers Association
5.	NEC	-	National Electrical Code

6.	IBC	-	International Building Code
7.	IFC	-	International Fire Code
8.	ADA	-	Americans with Disabilities Act
9.	NFPA	-	National Fire Protection Association

1.3 CODES

A. Codes for installation of electrical work shall be State of Washington Electrical Code, Electrical Safety Code, applicable rules and regulations and OSHA and Washington Industrial Safety and Health Act. Any violation of the above Safety Codes shall be cause for immediate termination of Contractor's authority to proceed with work, and recourse to surety for completion of the project.

1.4 PERMITS AND INSPECTIONS

A. Obtain permits and pay fees required by governmental agencies having jurisdiction over this work.

B. Arrange for inspections required during construction. On completion of work, furnish satisfactory evidence to show all work installed in accordance with codes.

1.5 CLEARANCES

A. Adequate working space shall be provided around electrical equipment for maintenance and operation. Minimum clearances shall conform to Art. 110-16 of N.E. Code.

1.6 TESTS

A. Test all wiring and connections for continuity and grounds before any fixtures or equipment are connected, and run a Megger test. Where such tests indicate faulty insulation or other defects, all such defects and faults shall be located, repaired and tested again.

B. Make check of proper load balance on 3-wire system and on phases of 3-phase system. Check direction of rotation and lubrication on all motors after final service connections have been made.

C. Make final tests in presence of Architect.

1.7 INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

A. All materials, equipment, and systems shall conform to the following applicable Industry Standards, Codes and Specifications:

1.	ANSI	-	American National Standards Institute
2.	IEEE	-	Institute of Electrical and Electronic Engineers
3.	IES	-	Illuminating Engineering Society
4.	IPCEA	-	Insulated Power Cable Engineers Association
5.	NFPA	-	National Fire Protection Association
6.	NEMA	-	National Electrical Manufacturers Association

7.	UL	-	Underwriters Laboratory
8.	IBC	-	International Building Code
9.	IFC	-	International Fire Code
10.	IMC	-	International Mechanical Code
11.	ADA	-	Americans with Disabilities Act (Washington State ADA/WAC51-30)
12.	WAC	-	Washington Administrative Code
13.	SEC	-	Seattle Electrical Code

B. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
2. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules, or regulations, comply with documents establishing the more stringent requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction.

B. Identify materials and equipment delivered to the Site to permit check against approved materials list, and reviewed submittals.

1.10 PROJECT CONDITIONS

A. Equipment Rough-In:

1. Rough-in locations for equipment furnished under other Divisions and for equipment furnished by Owner are approximate only. Obtain exact rough-in locations from the following sources:

a. From Shop Drawings for Contractor provided equipment.
b. From Architect for Owner furnished, Contractor installed equipment.

1.11 MATERIAL AND EQUIPMENT ENVIRONMENT

A. All equipment and material shall be suitable for the environment of the installation, and the installation including equipment shall satisfy the governmental agencies having jurisdiction

1.12 DRAWINGS AND SPECIFICATIONS

A. Specifications, with drawings, are intended to cover installation of all electrical equipment. Materials shown and called for on drawings, but not mentioned in specifications, or vice versa, necessary for proper completion and operation of equipment, shall be furnished the same as if called for in both.

B. Electrical drawings do not attempt to show complete details of project construction which affect electrical installations. Refer to architectural, structural and mechanical drawings for additional details which affect installation of this work.

1.13 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

E. Before installation Contractor shall make proper provisions for electrical work and to avoid interferences with installation of other work. Any changes caused by neglect to do so shall be made at Contractor’s expense.

F. Electrical drawings and specifications shall be compared with drawings and specifications of other trades and any discrepancies between them reported to the Architect prior to installation of work.

G. Coordinate and arrange work so there is no interference between wiring outlets, lighting fixtures, and raceways with sheet metal work, insert hangers, mechanical piping, and structural members.

1.14 CUTTING AND PATCHING

A. Do all cutting and patching for installation of the work. All cutting done carefully to prevent damage to work of other trades, and all patching done by mechanics skilled in the

trade affected, and subject to approval by Architect. Provide all work per Division 01. Work shall include:

1. All openings for removed equipment shall be patched or entire system replaced. No openings shall remain at completion of work.
2. Exterior cutting and patching shall be done by qualified Contractors. Patching of asphalt and concrete shall be per Division 01 and approved by Civil Engineers and Architect. Grass and earth patching, seeding, and sod work shall be per Division 01 and approved by the Landscaper, Civil Engineer, and Architect. All backfill per Division 01.
3. Painting: All exposed conduit, boxes, surface metal raceway, enclosures, multi-outlet assemblies shall be painted to match wall color. Where exact color unknown, coordinate with Architect to obtain color. All items shall be painted regardless of whether wall, ceiling, floor finish is painted.

1.15 RUBBISH AND CLEAN-UP

A. Contractor shall promptly remove waste material and rubbish caused by workers.

B. At completion of work, clean all fixtures, electrical panel interiors, switchboards, distribution centers, and all other equipment installed.

1.16 SCOPE OF WORK

A. Mention herein or indication on drawings of articles, materials, operations or methods, requires that Contractor provide each item mentioned or indicated, of quality, or subject to qualifications noted; perform according to conditions stated, each operation prescribed.

B. Work included under this contract provides for all labor, equipment, and materials to complete all electrical work as outlined in drawings and specifications for project.

C. The scope of this work is listed generally but is not limited to as follows:

1. Primary Service Arrangements
2. Incoming telephone. fiber, and television services
3. Lighting System and fixtures
4. Fire Alarm System
5. Branch wiring, power, lighting, and equipment
6. Equipment connections
7. Generator
8. Data and Telephone Cabling Rough In
9. Site electrical work
10. Television System
11. Communications System
12. Security/Access Control System
13. CCTV Security System Cabling
14. Complete Classroom AV System
15. Gym/Commons AV system
16. Stage/Music Room AV System

17. Dimming System
18. Low Voltage Lighting Control

1.17 SUBMITTALS

A. General:

1. Submittals shall be in accordance with requirements of Division 01 and as specified.
2. Forward all submittals to the Architect, together, at one time. Individual or incomplete submittals are not acceptable.
3. Organize submittals in same sequence as they appear in Specification Sections.
4. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or Drawing and Detail number.
5. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment. Words ″as specified″ are not sufficient identification.

B. Shop Drawings:

1. Show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weights.
2. Catalog cuts and published material may be included to supplement Shop Drawings.

C. Contract Closeout Submittals:

1. Provide full size copies of ″Record″ one-line diagrams, in metal frames with glass fronts. Locate diagrams as directed.
2. Operation and Maintenance:

a. Subsequent to final completion, and testing operations, instruct Owner’s authorized representatives in operation, adjustment, and maintenance of electrical plant.
b. Before Owner’s personnel assume operation of systems, submit operating and maintenance instructions, manuals, parts lists on electrical plant, its component parts, including all equipment which requires, or for which the manufacturer recommends, maintenance in a specified manner. Data sheets shall show complete internal electrical wiring, ratings, and characteristics, catalog data on components parts whether furnished by equipment manufacturer or others, names, addresses, and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.

D. Submit the equipment list to the Architect for final review. This list shall consist of, but not be limited to, the basic items applicable to the project as follows:

1. Lighting System and fixtures
2. Fire Alarm System
3. Branch wiring, power, lighting, and equipment
4. Conduit and Fittings
5. Generator
6. Site electrical work
7. Television System
8. Communications System
9. Gym/Commons sound system
10. Music Room Sound System
11. Classroom and Office AV System
12. Dimming Systems
13. Low Voltage Lighting control

1.18 ELECTRICAL EQUIPMENT MAINTENANCE MANUALS

A. The Electrical Contractor shall prepare maintenance manuals for the servicing of all equipment installed as a part of the construction contract.

B. The information contained in the manuals shall be grouped in an orderly arrangement under basic categories, i.e., Secondary Systems Equipment, Special Raceways, Motors & Controls, Lighting Equipment, etc.

C. Bind in 3-ring binder with label clearly indicating project.

1.19 JOB RECORD INFORMATION

A. Record drawings shall be continuously maintained in the field by the Contractor. Drawings used for this purpose shall be the latest revision and shall be kept neat and clean.

B. Drawings shall include dimensions on all underground conduit.

1.20 NAMEPLATES AND TAGS in Addition to 260553

A. The following items shall be equipped with tags or nameplates with etched letters:

1. All motors, transformers, motor starters, pushbutton stations, control panels and time switches.

    a. Disconnect switches, fused or unfused; switchboards and panelboards; circuit breakers, contactors or relays in separate enclosures.

2. Wall switches controlling outlets, or equipment where the outlets are not located within sight of the controlling switch. All low voltage lighting switches.
3. Special electrical systems shall be properly identified at junction and pull boxes, terminal cabinets and equipment racks.
4. Label all junction boxes with pen indicating type of system (i.e. Power, Data, etc.), circuit voltage, panel and circuit number and switch leg.
5. Paint all junction boxes with the following color code.

a.	Fire Alarm	Red
b.	Security	Yellow
c.	Normal 120/208	White
d.	Normal 277/480	Brown
e.	Sound	Purple
f.	Data	Blue
g.	Telephone	Blue
h.	Television	Gray
i.	Emergency 277/480	Dark Orange as acceptable to inspector
j.	Emergency 120/208	Light Orange as acceptable to inspector
k.	Low Voltage	Black

6. Label all data and telephone outlets and patch panels with manufacturer's labels. Labels per the owner.
7. Tags shall adequately describe the function of, or use of, the particular equipment involved. Tags for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 208V/120V." The name of the machine shall be the same as the one used on all motor starter, disconnect and P.B. station tags for that machine.
8. Tags for 120/208 volts shall be laminated phenolic plastic with white engraved letters on black background; for 277/480 volts, white on blue background. Tags for emergency systems identification shall be red with white lettering. Lettering shall be 3/16" high at pushbutton stations, thermal overload switches, receptacles, wall switches and similar devices, where the tag is attached to the device plate. All other locations, lettering shall be 1/4" high, unless otherwise detailed on the drawings. Tags shall be securely fastened to the equipment with screws or brass bolts. Contact cement is approved in dry locations. All tags and their installation are a part of this work.

1.21 FINAL SUBMITTALS

A. After completion of all electrical work and prior to final inspection, submit the following:

1. Letter addressed to Engineer, stating that Contractor, or superintendent in charge of job, has personally made a complete inspection of the job; that those items found to be defective in material or workmanship or not in conformance with drawings and specifications have been corrected; and that entire electrical job is ready for final observation by Engineer.
2. One copy of the electrical equipment maintenance manual (see 1.15) to be sent direct to Engineer for review, containing the following:

    a. Letter of transmittal, addressed to Engineer, containing a list of suppliers of replacement parts for all electrical equipment used on job.
    b. Panel, switchboard, and control drawings corrected to agree with Engineer's notations.
    c. Catalog cuts of all lighting fixtures, lamps, transformers, starters, special devices, door control system, and all other equipment used on job.
    d. All available maintenance data published.
    e. Wiring diagrams and operating instructions for all systems installed.

f. Marked-up set of prints showing exact location of all conduits and outlets deviating from original plans. Purchase prints new for this purpose. Prints not required to be bound in maintenance manual.
g. Signed receipts for all loose items i.e. keys, instructions and guarantee, etc.

3. Refer to Division 01 for Operations and Maintenance Manuals.

1.22 WARRANTY

A. Warranties shall be provided per Division 01. Where not indicated provide minimum 1 year (or standard manufacturers warranty if longer) warranty for all equipment installed on this project. Warranty shall include all labor, site visit, installation costs.

1.23 PAY REQUEST SUBMITTALS

A. In addition to the requirements of other Divisions of the Specifications, provide substantiating data for Architect's review for each pay request in a format similar to the attached form modified as required. (See Progress Draw Attachement, 1 & 2)

B. See Progress Draw Attachment, Pages 1 & 2.

1.24 COMMISSIONING

A. See specification 019113 and 260800.

PART 2 - – PRODUCTS

2.1 MATERIALS

A. Materials and Equipment General Requirements:

1. All items of materials in each category of equipment shall be of one manufacturer.
2. Groups of items having same or similar function shall be by single manufacturer to facilitate maintenance and service.
3. Compatible with space allocated. Modifications necessary to adjust items to space limitations shall be at Contractor's expense.
4. Conform with conditions shown and specified. Coordinate with other trades for best possible assembly of completed Work.
5. Install fully operating without objectionable noise or vibration.

B. Access Doors:

1. Furnish under this Division where shown, required by regulatory agencies, and for access to all concealed electrical items requiring access. Access doors shall be in accordance with requirements of Division 08. Doors in this Division, Division 08, and Division 15 shall be from the same manufacturer for identical appearance and keying. Furnish fire rated doors where required. Deliver access

doors for installation under Division 08. Mark each access door to accurately establish its location.

C. Firestopping and Smokestopping: Provide in accordance with Division 07.

1. Provide firestopping where wiring, conduit, or cable tray penetrates fire wall or floor.
2. Provide smokestopping where wiring, conduit, or cable tray penetrates smoke barrier.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic, Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - – EXECUTION

3.1 INSTALLATION

A. Mounting Heights: To center of device unless noted:

1.	Convenience outlets ---------- (Wiremold 4000)	1'-6" above floors, 6" above counters, 3" above back splashes
2.	Wall Switches ----------	44" to top above floor
3.	Keypad ----------	4’-0” to top above floor
4.	Fire Alarm Pull Station ----------	4’-0” to top above floor
5.	TV outlet ----------	1'-6", 7’-0” wall mounted
6.	F.A. Horns/Strobes ----------	80” to bottom
7.	Telephone/Data ----------	1'-6"
8.	Intercom Speaker ----------	7'-10" or centered between top of doors and ceilings except per Architect’s Elevations

B. Follow manufacturer’s directions in all cases where manufacturers of articles used furnish directions covering points not shown or specified.

C. Accurately set and level equipment with supports neatly placed and properly fastened. No allowance of any kind will be made for negligence on the part of the Contractor to foresee means of bringing in and installing equipment in position inside the building.

D. Conduit System:

1. Work into complete integrated arrangement with like elements. Make Work neat and finished appearing.
2. Run concealed, except where shown otherwise. Where exposed run parallel with walls or structural elements with vertical runs plumb, horizontal runs level; groups racked together neatly with bends parallel and uniformly spaced.
3. Flash and counterflash all penetrations through roof in accordance with requirements of Division 07 and as shown.

E. Provide hangers, supports, anchors and chases as required for installation of Electrical Work.

F. Excavating and Backfilling: In accordance with requirements of Division 02. Provide all necessary shoring, sheeting, and pumping as part of Work of this Division.

G. Concrete: In accordance with requirements of Division 3.

H. Interface with other products:

1. For purposes of clarity and legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, special fittings, and exact locations of items are not indicated, unless specifically dimensioned. Exact routing of wiring, and locations of outlets, panels, and other items shall be governed by structural conditions or obstructions. Contractor shall make use of data in Contract Documents. In addition, Architect reserves right, at no increase in Contract Sum, to make any reasonable change in location of electrical items exposed at ceilings or on partitions to group them in orderly relationships or to increase their utility. Verify requirements in this regard prior to roughing-in.
2. Take dimensions, location of doors, partitions, and similar features from Architectural Drawings. Verify at the Site under this Division. Consult Architectural Drawings for exact location of outlets, and other items to center with architectural features. Coordinate location of all ceiling mounted items with Division 09.

3.2 FIELD QUALITY CONTROL

A. Test panels and circuits for grounds and shorts with mains disconnected from feeders, branch circuits connected, and circuit breakers closed, all fixtures in place, permanently connected, grounding jumper to neutral lifted, and with all wall switches closed.

3.3 CLEANING

A. Properly prepare Work under this Division to be finish painted under Division 01.

3.4 EQUIPMENT IDENTIFICATION

A. Properly identify panelboards, circuit breakers in panelboards, disconnect switches, starters, and other apparatus used for operation or control of circuits, appliances or equipment.

3.5 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope

3.6 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

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SECTION 260513 – MEDIUM VOLTAGE CABLE AND TERMINATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes cables and related splices, terminations, and accessories for medium-voltage electrical distribution systems.

1.2 DEFINITIONS

A. NETA ATS: Acceptance Testing Specification.

1.3 SUBMITTALS

A. Product Data: For each type of cable indicated. Include splices and terminations for cables and cable accessories.

B. Qualification Data: For Installer and testing agency.

C. Material Certificates: For each cable and accessory type, signed by manufacturers.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with IEEE C2 and NFPA 70.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner except as scheduled during summer with minimum 3 weeks notice. All outages on premium time at time directed by owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cables:

a. American Insulated Wire Corp.; a Leviton Company.
b. General Cable Technologies Corporation.
c. Kerite Co. (The); Hubbell Incorporated.
d. Okonite Company (The).
e. Pirelli Cables & Systems NA.
f. Rome Cable Corporation.
g. Southwire Company.

2. Cable Splicing and Terminating Products and Accessories:

a. Engineered Products Company.
b. G&W Electric Company.
c. MPHusky.
d. Raychem Corp.; Telephone Energy and Industrial Division; Tyco International Ltd.
e. RTE Components; Cooper Power Systems, Inc.
f. Scott Fetzer Co. (The); Adalet.
g. Thomas & Betts Corporation.
h. Thomas & Betts Corporation/Elastimold.
i. 3M; Electrical Products Division.

2.2 CABLES

A. Cable Type: MV105. Single cable for each phase.

B. Comply with UL 1072, AEIC CS 8, ICEA S-93-639, and ICEA S-97-682.

C. Conductor: Copper.

D. Conductor Stranding: Compact round, concentric lay, Class B.

E. Strand Filling: Conductor interstices are filled with impermeable compound.

F. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 15kV.
2. Insulation Thickness: 133 percent insulation level.

G. Shielding: Copper tape , helically applied over semiconducting insulation shield.

H. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

I. Cable Jacket: Sunlight-resistant PVC.

J. Size: #1/0 unless noted otherwise.

K. Neutral and ground cables: 600 volt insulation. Separate cable for each.

2.3 TERMINATOR AND CONNECTORS

A. Load-Break Elbow Cable Terminators: Elbow-type units with 600-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

B. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.

1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

C. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.

D. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.4 ARC-PROOFING MATERIALS

A. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, compatible with cable jacket.

C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch (13 mm) wide.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576

B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

D. Support cables according to Division 26 Section "Common Work Results for Electrical."

E. Install all cables in conduit on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 4 inches (100 mm) of tamped earth. Install permanent markers at ends of cable runs, changes in direction, and buried splices.

F. Install "buried-cable" warning tape 12 inches (305 mm) above cables.

G. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables at intervals adequate to prevent sag.

H. Install terminations at ends of conductors and seal multiconductor cable ends with standard kits.

I. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.

5. Band arc-proofing tape with 1-inch- (25-mm-) wide bands of half-lapped, adhesive, glass-cloth tape 2 inches (50 mm) o.c.

J. Seal around cables passing through fire-rated elements according to Division 07 Section "Penetration Firestopping."

K. Install fault indicators on each phase where indicated.

L. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

M. Identify cables according to Division 26 Section "Identification for Electrical Systems."

N. Bury conduits minimum of 36” below grades.

3.2 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. High Potential (POTS) Test at 35 KV DC or IEEE VLF acceptance testing per 400.2 Table 5 states 20 kv withstand voltage for 15 kv cable for 30 minutes

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260513

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SECTION 260519 – ELECTRICAL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70. Minimum size - No. 12 AWG. Stranded for sizes No. 8 and larger, solid for No. 10 and No. 12.

C. Aluminum: Not Allowed

D. Conductor Insulation: Comply with NEMA WC 70. Drawings are based on using THHN-THWN cables. Contractor shall increase conduit size for any other insulation.

E. Ground Wire: Provide THWN ground wire in all circuits, sized per code. Raceway shall not be used as ground.

F. Control and Low Voltage Cable: Cable shall be as recommended by manufacturer. Contractor shall coordinate location of plenums in building with all other trades. Provide plenum rated cable whenever cable passes through a plenum for the entire length.

2.2 CONNECTORS AND SPLICES

A. Splices and Terminations

1. 600 Volt

a. Splices: Solderless type only. Preinsulated "twist-on" type permitted on solid conductor size number 10 and smaller. Hydraulic compression long barrel type with application preformed insulated cover, heat shrinkable tubing or plastic insulated tape for all stranded conductors. For stranded conductors provide terminations designed for use with stranded conductors.
b. Terminations: 250 kcmil and above - two hole long barrel compression lugs. Below 250 kcmil - single hole compression lug. Conductors No. 12 and smaller: provide eye or forked tongue compression lugs at bolted or screw connections - no lugs required for compression style terminal blocks.
c. Cable Ties: Nylon or accepted, locking type. Use a torque limiting tool for installation of ties.

2. Control Cable Splices and Terminations

a. Splices: Preinsulated crimp pigtail or butt splice connectors.
b. Terminations: Locking spade, insulated, compression lugs.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Type THHN-THWN, single conductors in raceway.

B. Branch Circuits: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control and Low Voltage Circuits: Type THHN-THWN, in raceway, or as required by manufacturer. Plenum rated where required. Cable shall not be installed in slab or under ground. All circuits shall be installed in raceway when installed in walls and non-accessible spaces.

E. Service Entrance: With USE label.

3.2 BRANCH WIRING

A. General: Complete system of conduit required to all light outlets, receptacles, switches, etc. as shown. Conduit size as shown on drawings, except where no size is shown, conduit shall be sized per National Electrical Code. No conduit shall carry more than 8 conductors. All exposed switches, receptacles or outlet boxes for other purposes, install die cast boxes, except where specifically noted otherwise. Feeder cables shall have each phase identified according to the established code.

B. Coding: Branch circuit color code shall be: For 120/208 V. Black – Phase A, Red – Phase B, Blue – Phase C, White – Neutral, Green – Ground, Isolated Ground – Green with Yellow stripe, Purple “Travellers” on 3 and 4 way switching. For 277/480V. Brown (A), Orange (B), Yellow (C), and Gray neutral. Where colors are not available (No. 4 and larger) all terminals shall be coded, both on the wire and on the terminal. Phase and neutral wires shall appear in the same position and rotation at all appearances.

3.3 EQUIPMENT WIRING

A. General: Wiring connections for power and control for all equipment shall be complete including disconnect switches and controls unless otherwise specified or noted on drawings.

B. Control wiring for mechanical systems installed under this section of specifications shall be in accordance with mechanical drawings and specifications.

3.4 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in raceway in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Exposed cables not permitted.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and branch conductors for compliance with requirements.

    a. Megger Test

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 4 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems, based on NFPA 70B.

    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Insulated Ground Conductors: Per 260519.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet in diameter or as required by code authority.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 3/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Equipment Ground Conductors: Green colored insulation. Provide in all raceways.

D. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors or exothermic weld where required by code authority.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.3 GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least four (4) rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 3/0 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

I. Separately Derived Systems (Transformers): Bond to structural steel, main waterpipe within five feet of waterpipe entry to building, or building grounding electrode.

J. Consult with code authority and comply with all code authority requirements.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. IBC: International Building Code

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

E. All supports shall comply with IBC, Washington Seismic Zone, Building Use Group III.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.

3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Not permitted.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

H. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

I. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES (HOUSEKEEPING PADS)

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

J. RGS: Rigid galvanized steel

K. PVC: Polyvinyl Chloride

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.

c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: Not permitted.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: ANSI C80.3. Hot dipped galvanized inside and outside.

G. FMC: Aluminum.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, compression or set screw type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

K. MC Cable, NMSC, NMC: Not permitted.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13. Not permitted

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated as PVC 80.

D. LFNC: Not permitted.

E. Fittings for Elbows and Sweeps shall be plastic coated rigid galvanized steel RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: Not permitted.

2.3 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R when outside, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum size: 4-inch by 4-inch by 1 ½-inch. Voice/data/AV boxes minimum 2 1/8-inch deep.

1. Exception: AV boxes shall be deep, mnimum 3” for special applications shown on shop drawings

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Not permitted.

E. Metal Floor Boxes: Legrand/Wiremold Evolution Series #EFB8S (ON UPPER FLOORS), #EFB8S-OG (ON GRADE), #EFB8S-FC (FIRE RATED 2HR). Provide flush concrete kit #EFB610CTR (FOR EXPOSED CONCRETE FLOORS). Provide EFB610 Cover with solid lid for all floor boxes. Submit colors to Architect for approval prior to ordering. Provide minimum 8 mounting locations with devices shown on drawings. Where spare, provide duplex receptacle mounting plate.

F. Metal Floor Boxes in Commons: Cast Iron non-skid type. CW Cole#TLS354-FE

G. Nonmetallic Floor Boxes: Not permitted.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

K. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.6 SLEEVE SEALS

A. Basis-of-Design Product:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. All conduit sizes on drawings are based on EMT. Any alternate raceway used shall have it’s size adjusted per the NEC

B. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT.
3. Underground Conduit: Rigid Steel Conduit or RNC, Type EPC-40-PVC, direct buried with plastic coated RGS bends and sweeps. See 260543.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

C. Comply with the following indoor applications, unless otherwise indicated:

1. Fire Alarm, Lighting, and Power: All circuits in raceway per below. No open cable permitted.
2. Exposed, Not Subject to Physical Damage: EMT. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT. Homeruns minimum 1”
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Communications and Electronic Safety and Security: Shall be EMT overhead. Underground is not permitted except for connections between MDF and IDF’s. See 260534.

F. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

G. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers, Supports and Fasteners."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from RNC Type EPC-40-PVC to plastic coated rigid steel conduit or EMT before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
d. Attics: 135 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT – SEE SECTION 260534

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.9 ADDITIONAL MATERIALS

A. Provide 10 additional receptacles, each with 50 feet of ¾" EMT and 5#12. Include cost of installation. Locate at locations field directed by architect. Any items not used to be provided to the owner at project completion.

END OF SECTION 260533

dj/July 17, 2017

SECTION 260534 – BOXES AND RACEWAYS FOR COMMUNICATION AND SIGNAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for raceways, fittings, and boxes specific to communications circuits for fire alarm, security, CCTV, sound, television, voice, and data which are additional to, or different from, that of Division 260533.

1.3 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.

1. General:

   a. National Electrical Code (NEC)
   b. National Electrical Safety Code (NESC)
   c. Washington Industrial Safety and Health Act (WISHA)
   d. Occupational Safety and Health Act (OSHA)

2. Communications:

   a. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard
   b. TIA/EIA - 568A2: Corrections and Additions to TIA/EIA 568A
   c. TIA/EIA - 569A: Commercial Building Standard for Telecommunication Pathways and Spaces
   d. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   e. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
   f. TIA/EIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
   g. ISO/IEC IS 11801: Generic Cabling for Customer Premises
   h. BICSI: BICSI Cabling Installation Manual

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of conduit, multi-outlet assemblies (SMR), device boxes, fittings, enclosures, pull boxes, hangers/supports, backboards, and other raceway incidentals and

accessories as required and as detailed in Division 260533 and 262726 except where specifically noted below.

2.2 MATERIALS

A. Conduit: Minimum conduit size shall be 1 inch. Provide EMT, IMC or RGS

1. Underslab or Underground: NOT ALLOWED
2. Minimum Size for AV Shall be 1.25 inch
3. Provide metallic bushing on all conduit
4. All conduit bends shall comply with EIA/TIA standards for Category 6 cabling installation (8x minimum bending radius)

B. Device boxes: Provide device boxes as follows:

1. For flush outlets to be used for wall mounted telephones:

a. Device boxes shall be single gang 2.125" depth with single gang extension rings covers ((i.e. device covers, mud rings).

2. Surface mounted outlets – Not allowed:
3. For all other outlets:

a. Device boxes shall be double gang deep depth with single or double gang extension rings (i.e. device covers, mud rings) unless otherwise noted on the Drawings. Combined depth of device box and extension ring shall be 2-3/4".

C. Backboards: Provide backboards which are 5/8" A-C fire treated plywood, void free, 8-ft high unless otherwise noted, capable of supporting attached equipment, and painted with a minimum of two coats of fire retardant light gray semi gloss paint.

D. Pull Boxes: Provide pull boxes (junction boxes) as shown on the Drawings and as required. 90 degree condulets (LB's) are not acceptable.

1. Pull boxes shall be sized as follows:

Trade Size Conduit	Box Size Width	Length	Depth	Maximum For Each Additional Conduit Increase	Width
1"		4"	16"		3"
				2"	
1-¼"		6"	20"		3"
				3"	
1-½"		8"	27"		4"
				4"	
2"		8"	36"		4"
				5"	

E. Firestopping: Provide firestopping material to maintain the fire rating of all penetrated walls, floors, and ceiling structures. Material shall be acceptable to the local fire and

building authorities as well as applicable codes and shall be removable. Firestopping material shall be:

1. Specified Tech. Inc.

F. Grounding Conductor: Provide #6 AWG insulated solid copper conductor (green) to bond all metallic raceway to the nearest grounding bus bar

G. Labels: Provide labels as recommended in TIA/EIA 606. Labels shall be permanent/legible typed and created by a Brady LS-2000 label maker or equivalent system. Handwritten labels are not acceptable. Labels are required for all raceway and pull boxes.

H. Cable Tray: By owner.

I. Pull Strings: Provide pull strings in all conduit with tag on each end.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall comply with Division 260533.

B. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

C. The Contractor shall follow all applicable safety rules and regulations including OSHA and WISHA. The National Electrical Safety Code (NESC) and the NEC shall be strictly followed except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

D. All work shall comply with the standards, references and codes listed in Part 1 — References above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

E. The Contractor shall install all components strictly to manufacturers recommendations.

F. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the TIA/EIA, ISO/IEC and BICSI references listed in Part 1 — References, above.

G. If raceway (conduits, sleeves, etc.) is installed after walls are installed and/or after finish to walls has been applied, wall penetrations shall be sealed, patched and painted to match condition and finish of undisturbed wall.

H. Upon project completion, all surplus material and debris shall be cleared from the job site and legally disposed of.

3.2 INSTALLATION

A. Conduit:

1. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored, or over or adjacent to boilers, incinerators, hot water lines, or steam lines.
2. Conduit bends:

    a. A conduit bend shall not exceed 90 degrees.
        1) For conduit up to 2", the bend must be at least 8 times the internal diameter of the conduit.
        2) For conduit greater than 2", the bend must be at least 10 times the internal diameter of the conduit.
    b. The sum total of conduit bends for a section of conduit shall not exceed 180 degrees, except as noted below:
        1) One additional bend of up to 90 degrees is acceptable if the bend is located within 12 inches of the cable feed end.
    c. 90 degree condulets (LB's) are not acceptable.

3. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Cap each conduit with a mechanical-type seal for protection. Equip all conduits with a plastic or nylon pull string with a minimum test rating of 200 lb.
4. Terminate conduits that protrude through a floor 1" to 3" above the surface of the floor. Conduits stubbed to ceiling shall be clear of all casework and obstacles on floor below. Also conduits shall be located to be easily accessible and not blocked by structural members, ductwork, piping, equipment, etc.
5. Label each conduit end in a clear manner by designating the location of the other conduit end (i.e. room name, communications closet name, junction box number, etc.). Indicate conduit length on the label.

B. Device Boxes: Set device boxes plumb, level, square and flush with wall. Do not exceed more than 1/16" tolerance for each condition.

C. Pull Boxes: Install pull boxes in an exposed location, readily accessible both at time of construction and after building occupation. Pull boxes shall not be installed in interstitial building space.

1. Do not exceed one pull box per total conduit run between device box and termination point in a communications closet.
2. If mounting pull box on ceiling structure above ceiling grid, do not mount higher than 4' above grid (mount on wall instead).
3. A pull box may not be substituted for a 90 degree bend.
4. Install pull boxes such that conduit enters and exits at opposite ends of the box as follows:

D. Grounding/Bonding: All grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, UL 467, and ANSI/TIA/EIA standards listed in Part 1 — References above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond all metallic raceway at both ends to the nearest grounding bus. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic raceway.

E. Provide pull strings in all conduit.

F. Provide metallic grounding bushings on all raceways.

END OF SECTION 26 0534

dj/July 17, 2017

SECTION 260543 – UNDERGROUND ELECTRICAL CONDUIT

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all materials and labor for the installation of a pathway system underground circuits. Work in this section includes excavation and trenching, duct (raceway) construction, cutting and patching, concrete, underground cable vault (UCV) construction, and landscaping.

1. This Section includes requirements for the above work which specifically pertain to outside plant communications and which are more stringent, additional to, or different from that of the Division 2, Division 3, and Division 26 sections listed under Related Sections, below.

1.2 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.

1. General:

a. National Electrical Code (NEC)
b. National Electrical Safety Code (NESC)
c. Washington Industrial Safety and Health Act (WISHA)
d. Occupational Safety and Health Act (OSHA)
e. WSDOT/APWA 1998 Standards Specifications for Road, Bridge and Municipal Construction (APWA Standard Specifications)

2. Communications:

a. TIA/EIA - 758: Customer-owned Outside Plant Telecommunications Cabling Standard
b. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard
c. TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
d. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
e. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
f. ISO/IEC IS 11801: Generic Cabling for Customer Premises

3. Trenching and Backfill:

a. ASTM D1557: Test Method for Laboratory Compaction Characteristics Using Modified Effort

1.3 DEFINITIONS

A. Aggregate: The mineral materials such as sand or stone used in making concrete

B. Backfill: Earth material used specifically for filling and grading excavations back to a finished state. Backfill is placed on top of the bedding surrounding encased ductbanks and direct-buried conduits.

C. Base: Earth material used specifically to level and grade an excavation's subgrade for the subsequent placement of encased ductbanks, direct-buried conduit, and UCVs. Base material is placed on top of the subgrade and beneath the bedding surrounding encased ductbanks, conduits, or UCVs.

D. Bedding: Earth material used specifically for filling excavations. Bedding is placed around encased ductbank, conduits, or UCVs. Bedding is placed on top of the base and beneath the backfill.

E. Fill: The collective term for base, bedding, and backfill.

F. Handhole/Pullhole: A small UCV in which it is expected that a person cannot enter to perform work. Handholes/pullholes are used for the placement of cable only, they are not used for splicing or for equipment.

G. Manhole: A large UCV in which it is expected that a person can enter to perform work. Manholes may be used for splicing and outside-rated telecommunications equipment.

H. RNC: Rigid Non-Metallic Conduit (PVC)

I. RGC: Rigid Galvanized Steel Conduit.

J. PSC: PVC Coated Rigid Steel Conduit.

K. Underground Cable Vault (UCV): Underground vaults (manholes, or handholes/pullholes) which are used for the routing of communications cable.

1.4 SUBMITTAL INFORMATION

A. The Contractor shall provide shop drawing submittal information for review before materials are delivered to the job site.

1. Provide material and equipment submittals for each item of equipment as follows:

a. For items which are being provided exactly as specified, do not provide submittal information. Instead, provide written documentation stating that the items are to be provided as specified.

2. For those items noted as allowing "or equal," and which are not being provided as specified, provide standard manufacturer's cut sheets or other descriptive information and a written description detailing the reason for the substitution.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials shall consist of fill, topsoil, concrete formwork, concrete, raceway, UCVs, and other incidentals and accessories as required.

2.2 BASE, BEDDING AND BACKFILL

A. Use of on-site soils for base, bedding, and backfill is not acceptable.

B. Base: Base material shall have size and shape characteristics that will allow it to compact readily and shall conform with the following gradation requirements.

1. For UCVs (provide gravel):

Sieve Size	Percent Passing
1” Square	100
¼ “ Square	25 - 80
U.S. No. 200	15.0 max
Sand Equivalent	30 min

2. For Trenches (provide sand):

Sieve Size	Percent Passing
U.S. No. 10	35 - 100
U.S. No. 20	20 - 80
U.S. No. 40	10 - 55
U.S. No. 100	0 - 10
U.S. No. 200	0 - 3

C. Bedding: Same as Base - For Trenches, above.

D. Backfill:

1. For UCVs - Same as Base - For UCVs, above.
2. For Trenches

Sieve Size	Percent Passing
½ “ Square	100
¼ “ Square	65 - 100
U.S. No. 10	40 - 100
U.S. No. 50	3 - 50
U.S. No. 100	0 - 4
U.S. No. 200	0 – 3

2.3 DUCTS AND DUCTBANKS

A. Ducts: Provide in locations as shown on the drawings. Refer to Part - 3, Execution for details on when to use each type. All conduit, fittings, and adhesives shall be provided by the same manufacturer.

1. Types:

a. Rigid Non-Metallic Conduit (RNC):
   1) RNC shall be NEMA TC 2 schedule 40 or 80 (see Part - 3, Execution for details on when to use each type) rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement. RNC shall be UL listed.
   2) Fittings shall be NEMA TC3, matched to conduit and material.
   3) Bends and sweeps shall be PSC

b. Rigid Galvanized Steel Conduit (RGC):
   1) RSC shall be rigid steel conduit hot-dipped galvanized inside and out with threaded ends meeting ANSI C80.1.
   2) Couplings: Unsplit, NPT threaded with galvanizing equal to and compatible with conduit. Running thread or set screw threaded fittings (except for three piece and watertight split couplings) are not acceptable.
   3) Nipples: Factory made through eight inches with no running threads.

c. PVC Coated Rigid Steel Conduit (PSC):
   1) PSC shall be NEMA RN 1 rigid steel conduit coated with rigid polyvinyl chloride (PVC) inside and out.
   2) Fittings shall be NEMA RN 1.

2. Fittings:

   a. Bends/Sweeps:
      1) Unless otherwise noted on the Drawings, bends/sweeps shall be factory manufactured.
      2) Unless otherwise shown on the Drawings, bends shall consist of a single arc of not less than a 15 foot radius. Where this is not possible, a bend radius shall not be less than 10 times the internal diameter of the conduit for communications circuits.
      3) Unless otherwise shown on the Drawings, the use of 90 degree elbows, LB's, condulets, or the use of a UCV in place of a bend/sweep is not acceptable for communications circuits.
   b. End Caps (Plugs): Provide pre-manufactured water-tight end caps for all ducts during construction. Tape is not an acceptable end cap or cover.
   c. End Bells: Provide end bells for terminating conduit in UCVs. Do not provide for conduit ends terminating in UCVs which are equipped with TERM-A-DUCT.

3. Pull Cords: Provide nylon pull cord indicating length measurement for each duct. Pull cord strength shall be a minimum of 130 pounds.

B. Ductbanks:

1. Duct Spacers/Supports: Provide high-density plastic interlocking spacers/supports to maintain uniformity of multiple ducts within a ductbank. Spacers shall be:

   a. Underground Devices Inc.: WUNPEECE

2. Warning Tape: Provide metallic warning tape above each ductbank. Tape shall be 6" wide and orange in color.
3. Grounding/Bonding: Provide #2 bare ground along length of ductbank.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances. Fenced barriers, steel plate covers, warning indicators, proper shoring, etc. are all the sole responsibility of the Contractor.

B. The Contractor shall follow all applicable safety rules and regulations including OSHA and WISHA. The National Electrical Safety Code (NESC) and the NEC shall be strictly followed except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in Part 1 — References above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. The Contractor shall install all components strictly to manufacturers recommendations.

E. Upon project completion, all surplus material and debris shall be cleared from the job site and disposed of in a legal manner by the contractor.

3.2 EXCAVATING, TRENCHING AND FILL

A. Excavation:

1. Excavations shall not be performed where the outside temperature is less than 35 F or when there is standing water or snow on the subgrade.
2. Excavations requiring crossing of concrete or asphalt shall be performed only after the surface material has been saw cut and removed. Concrete shall be removed in complete sections from control joint to control joint regardless of the width of the excavation. Concrete and asphalt shall be replaced to match existing depth, strength, color, and type of material. Coordinate with and obtain approval from AHJ.
3. Adjacent structures which may be compromised or damaged by excavation work shall be underpinned as evaluated and recommended by a registered structural engineer employed by the contractor prior to proceeding with the work.
4. The Contractor shall maintain adequate separation between the excavation and adjacent underground utilities. The excavation shall be located such that ductbank and UCVs, when installed, shall have a minimum separation of twelve (12) inches between the ductbank and UCV and the nearest underground utility. For gas lines a minimum separation of eighteen (18) inches is required. For water/sewer a minimum separation of thirty-six (36) inches is required.

5. Excavations shall not be left unprotected at the end of the work shift. Excavations shall be covered with steel sheets and barricaded prior to leaving the job site, in accordance with all applicable rules, regulations, building codes, and ordinances.
6. The Contractor shall not allow water to accumulate in excavations. The Contractor shall install, operate and maintain all pump or dewatering equipment necessary to meet this requirement.
7. Depth of excavation

    a. For UCVs: Depth shall allow for the overall assembled height of the vault plus the added height of risers, covers and bedding material consisting of a minimum six (6) to twelve (12) inches of base. Width of excavation for UCVs shall provide for a minimum of six (6) inches clearance around each side of the UCV.
    b. For trenches: Depth shall be sufficient to cover a minimum of twenty-four (24) inches over the conduit or ductbank formation. Width of excavation for trenches shall be a minimum of six (6) inches to each side of the ductbank formation. Depth of excavation for trenches shall allow for the proper alignment of ducts into UCVs.

8. Soft spots in the subgrade shall be over-excavated, filled, and compacted under supervision of soils engineer.
9. Excavation for trenching shall run true and as straight as practicable. Trenches shall be clear of stones and soft spots.
10. Coordinate slope with actual conditions in field.
11. Trench grade shall be sloped to fall 3 inches per 100 feet in general and ¼" per foot where possible. Slope shall fall toward lower UCVs or from high points toward both UCVs.

B. Fill:

1. Prior to the placement of fill, all groundwater and surface water shall be drained and/or pumped from the recipient area.
2. Frozen fill shall not be placed.
3. Base:

    a. The subgrade bed to receive fill shall be scarified and moisture conditioned prior to placing materials.
    b. Base material shall be moisture conditioned to within three (3) percent of optimum moisture content and shall be placed in loose, horizontal layers.
    c. The subgrade bed shall be leveled using sand for trenches and gravel for UCVs as necessary to form an even base.

4. Bedding:

    a. For concrete encased ductbank:
        1) Bedding lifts/layers shall not exceed 4 inches before compaction.
    b. For Direct-buried Ductbank:
        1) Lifts/layers shall not exceed 1 to 2 inches before compaction until the top of the ductbank is reached and shall not exceed 4 inches thereafter. Bedding shall be placed simultaneously on both sides of ductbank for the full width of the trench. The

materials shall be carefully worked above, to each side, and below the ducts with a tool capable of preventing the formation of void spaces and without damaging the structure or waterproofing of the ducts.

5. Backfill:

a. Backfill lifts/layers shall not exceed 6 inches before compaction.

6. Compaction: Compaction shall be performed using a vibratory plate or roller or other mechanical device. Compaction through jetting and/or ponding is not acceptable. Compact per APWA Standard Specification Paragraph 7-10.3 (11).

a. Bedding: Material shall be compacted to a dense state equaling at least 95% of the maximum dry density per ASTM D1557.
b. Backfill: Material shall be compacted to within two (2) feet of the finished surface with a minimum relative compaction of 90% of the maximum dry density per ASTM D1557. Material within two (2) feet of the finished surface shall be compacted with a minimum relative compaction of 95% of the maximum dry density per ASTM D1557.

C. Waste Disposal: The Contractor shall remove all excavation materials and other construction debris from the site in a timely manner. Materials shall be disposed of legally.

3.3 DUCTS AND DUCTBANKS

A. Ducts:

1. The type of duct to use shall be dictated by the application:

a. Outdoor underground – direct buried: Provide RNC Schedule 40 (Type I) or PSC.
1) Transition to PSC at stub up locations and at entrances to buildings or other locations where the raceway changes from direct buried to encased in concrete or exposed conditions.
2) Transition to PSC or RGC for short radius bends (i.e. bends with less than 15-foot radii sweeps).
b. Outdoor underground – concrete encased: Provide RNC Schedule 40 (Type 1).
1) Transition to PSC at stub up locations and at entrances to buildings or other locations where the raceway changes from encased in concrete to direct buried or exposed conditions.
c. Exposed or within five feet of steam lines or Utilidor trenches : Provide RGC.

2. Fittings:

a. Duct ends shall be cut square and reamed to remove burrs and sharp ends. Duct shall extend the maximum distance into all fittings, couplings,

and/or connectors. All fittings shall be tightened securely and sealed watertight (see below).

b. Ensure that bends/sweep radii are detailed on the drawings.

c. Bends/Sweeps:

1) Unless otherwise shown on the Drawings, bends shall consist of a single arc of net less than a 15 foot radius. Where this is not possible, a bend radius shall not be less than 10 times the internal diameter of the conduit for communications circuits.

2) Unless otherwise shown on the Drawings, an individual bend shall not exceed 90-degrees.

3) Unless otherwise shown on the Drawings, a duct section may have no more than the equivalent of two 90-degree bends (a total of 180 degrees) between pull points. The 180-degree maximum shall include kicks and offsets. Where it is not possible to construct a section of duct within the 180-degree bend maximum, intermediary UCVs must be installed.

4) Two 90-degree bends separated by less than 10' is not permissible.

5) Bends for ducts within a common ductbank shall be parallel, measured from the same center-point.

6) Where factory manufactured bends cannot be obtained due to a unique bend radius, bends shall be formed only with factory recommended equipment and shall be manufactured in such a way as to ensure that the internal diameter of the duct is not changed.

d. End Caps (Plugs): End caps shall be placed on all duct ends throughout construction in order to prevent the intrusion of water or debris. End caps shall be installed on all duct that is not directly being worked on during the work day and on all ducts at night. End caps shall be left in place upon final completion of the work.

e. End Bells: For UCVs which are not equipped with TERM-A-DUCT, install protective end bells on ducts flush with UCV wall.

3. Sealing: Duct connections shall be made waterproof and rustproof by application of a watertight, conductive thread compound (for RGC and PSC) or by solvent-type cement (for RNC). Duct terminations in UCVs shall be sealed and grouted (to ensure that all voids in the joints are filled).

4. Test Mandrels: Each duct, once installed, shall be cleaned of debris with a wire brush or swab and shall be proven out with a minimum 16 inch long test mandrel which is ¼ inch smaller than the inside diameter of the duct. Test mandrel shall be pulled after backfilling but prior to the replacement of landscaping. The Contractor shall repair any duct that does not prove out at no cost to the Owner.

5. Duct Entrances: Duct entrances at opposite ends of a UCV shall be at the same level and in the same position with respect to the side walls. The Contractor shall ensure that each duct leaving a UCV in any position shall enter the next UCV in the same relative position.

6. Ensure that maximum lengths are calculated.

7. Length: Unless otherwise shown on the Drawings, the maximum length of a duct run shall not exceed 600 feet between UCVs or pulling points. Install additional UCVs as required to maintain spacing.

8. Pull Cords: Install in each duct immediately after the duct has been mandreled. Leave a minimum of 10 feet looped and tied off at each end of the duct.
9. Protection: Insure that after installation all duct coatings and finishes are without damage. Repair as follows:

    a. PVC Coated Rigid Steel Conduit: Patch all nicks and scrapes in PVC coating after installing conduits.
    b. Rigid Galvanized Steel Conduit: Repair damage to galvanized finishes with zinc-rich paint as recommended by the manufacturer.
    c. Rigid Non-metallic Conduit: Repair damage with matching touchup coating recommended by the manufacturer.

B. Ductbanks:

1. Duct Spacers/Supports: Supports shall be spaced on eight (8) foot centers if encased in concrete and five (5) foot centers otherwise. Spacers shall be interlocked horizontally only. Spacers encased in concrete shall be staggered at least six (6) inches vertically.
2. Warning Tape: Install metallic warning tape six (6) inches below grade and eighteen (18) inches above the ductbank
3. Grounding/Bonding: Install ground wire along length of ductbank.

END OF SECTION 260543

dj/July 17, 2017

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power: White letters on a black field.
2. 277 Volt Power – White letters on blue
3. Emergency Power: Black on red as dictated by inspector
4. Fire Alarm: White on red.
5. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Labels: Preprinted, laminated hard label with a clear, weather- and chemical-resistant coating.

D. Snap-Around Labels for conduit: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, Engraved, Laminated Acrylic or Melamine Label, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated. Minimum size = 1/4".

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with letters per above. Minimum letter height shall be 3/8 inch.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Junction Boxes: All junction boxes shall be painted per the following color code and 260050:

1. 277 Volt Normal: Brown
2. 120 Volt Normal: Black
3. 277 Volt Emergency: Red or orange
4. 120 Volt Emergency: Red or orange
5. Fire Alarm: Red
6. Intercom/Clock: Gray
7. Data/Phone: Blue
8. Television: White
9. Sound: Purple

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.7 PANEL DIRECTORIES

A. Directory: Provide typewritten circuit directory on the inside of each panel door under plastic cover, identifying the type and location of every load. At lighting and receptacle circuits, indicate room numbers and names. All room numbers shall be as furnished by the Owner. All replaced or modified panels shall be provided with new directories.

B. Identification: Spare circuits will be identified as such in pencil. Permanent room numbers, as furnished by owner, shall be used for location identification.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label or snap-around label or self-adhesive vinyl tape applied in bands.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use aluminum wraparound marker labels. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
2. Power transfer switches.
3. Controls with external control power connections.
4. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-

high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Stenciled legend 4 inches high.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Transformers.
e. Emergency system boxes and enclosures.
f. Motor-control
g. Disconnect switches.
h. Enclosed circuit breakers.
i. Motor starters.
j. Push-button stations.
k. Power transfer equipment.
l. Contactors.
m. Remote-controlled switches, dimmer modules, and control devices.
n. Power-generating units.
o. Voice and data cable terminal equipment rough in
p. Master clock and program equipment.
q. Intercommunication and call system master and staff stations.
r. Television/audio components, racks, and controls.
s. Fire-alarm control panel and annunciators.
t. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
u. Monitoring and control equipment.
v. Junction boxes: System, voltage and circuit with black pen.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and

floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White

3. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 260553

SECTION 260573 – POWER SYSTEMS PROTECTIVE DEVICE STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide a System coordination study for both the normal and emergency system
2. Short circuit study for both the normal and emergency system.
3. Protective device calibration and setting.
4. Arc fault study per NEC 70E. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the one-line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one-line drawings. This includes switchgear, switchboards, panelboards, motor control centers, automatic transfer switches, VFD's, and transformers. The study will include creation of Arc Flash Hazard warning labels. These labels serve as a guide to assist technicians and others in the selection of proper personal protective equipment when working around exposed and energized conductors. Electrical contractor shall install the labels.
5. A stamped report stating the coordination engineer has provided a fully selectively coordinated system per NEC 700 and 702.

1.2 SCOPE

A. It is the intent of these tests to assure that protective devices are operational, correctly applied, within industry and manufacturer's tolerances, and installed in accordance with the specifications. This effort should minimize the damage caused by any electrical failure. The testing agency shall verify that the electrical system and electrical equipment configuration matches the contract documents, vendor shop drawings, and the electric system coordination study recommended settings.

B. Prepare a coordination study for the specific electrical overcurrent devices and feeder lengths, to be installed under this project, from the primary overcurrent protective device to the branch circuit breaker panels to assure proper equipment and personnel protection.

C. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source at Puget Sound Energy. The study shall reflect the operation of each device during normal and abnormal current conditions, and confirm that devices are coordinated.

D. The study shall coordinate the emergency system to meet NEC 700, 701, and 702. The system shall selectively coordinate to comply with all requirements of 700.27 and 701.18. all equipment provided under Panels, Switchboards, Circuit Breakers, Fusing, Controllers, etc. shall be designed and provided by the contractor to comply with the selective coordination requirements of the code. Study shall be completed and accepted by the engineer prior to ordering any equipment.

E. Provide arc fault/flash study per NFPA 70E.

1.3 APPLICABLE CODES, STANDARDS AND REFERENCES

A. Inspection and tests shall be in accordance with the following codes and standards except as provided otherwise herein:

1. American National Standards Institute ANSI C2: National Electrical Safety Code
2. American Society for Testing and Materials – ASTM
3. Association of Edison Illuminating Companies – AEIC
4. Institute of Electrical and Electronic Engineers – IEEE
5. Insulated Cable Engineers Association – ICEA
6. International Electrical Testing Association NETA Maintenance Testing Specifications MTS- 1989
7. National Electrical Manufacturer's Association – NEMA
8. National Fire Protection Association – NFPA

    a. ANSI/NFPA 70: National Electrical Code
    b. ANSI/NFPA 70B: Electrical Equipment Maintenance
    c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    d. ANSI/NFPA 78: Lightning Protection Code
    e. ANSI/NFPA 101: Life Safety Code
    f. NFPA 70E

9. Occupational Safety and Health Administration – OSHA
10. State and local codes and ordinances

1.4 SUBMITTALS

A. Submit the following in accordance with Division 01:

1. Protective equipment shop drawings with the protective device study. The one-line diagram showing available fault currents and timing of devices shall be submitted both as hard copies and as two electronic copies of Autocad drawings on Compact Disc. Two electronic copies of both the Dapper and Captor software files shall be provided on Compact Disc. An index shall be provided which cross references the file names on these disks to the specific pieces of equipment or system.
2. Certifications: Two weeks prior to final inspection, the Contractor shall deliver four copies of the following certifications to the Owner's representative:

    a. That the protective devices have been adjusted and set in accordance with the approved protective device study.
    b. That tests and settings have been witnessed by the Owner.
    c. Report of results.

3. Short circuit study in conjunction with, and at the same time as, the submittal for Panelboards. The study shall show fault currents available at key points in the system down to a fault current of 7000A. The purpose of this submittal is to verify the fault current ratings of the panelboards.

1.5 QUALIFICATIONS

A. The coordination study shall be prepared by qualified engineers of the switchgear manufacturer or an approved consultant. Provide pertinent information required by the preparers to complete the study.

B. The short circuit study and coordination study shall be performed on the Dapper and Captor computer software packages. No substitutions.

C. Preapproved: Electrotest, Power Systems Engineering, Siemens Engineering Service Division, Cutler Hammer.

PART 2 - EXECUTION

2.1 REQUIREMENTS

A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.

B. One-Line Diagram:

1. Show, on the one line diagram, electrical equipment wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
2. Show reference nodes on the one line diagram referring to a formal report, to include the following specific information:

    a. X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the bus of the main switchboard, and all downstream equipment containing overcurrent devices.
    b. Breaker and fuse ratings.
    c. Transformer KVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
    d. Voltage at each bus.
    e. Identifications of each bus.
    f. Conduit material, feeder sizes, and length.
    g. Calculated short circuit current.

C. Short Circuit Study:

1. Determine the available 3 phase short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
2. The study shall be calculated by means of the Dapper computer software package. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
3. Present the data determined by the short circuit study in a table or report format. Include:

    a. Device identification.
    b. Operating voltage.

c. Protective device.
d. Device rating.
e. Calculated 3 phase short circuit current (asymmetrical and symmetrical), and ground fault current.

D. Coordination Curves:

1. Prepare the coordinations curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between existing and supplied series devices. Plot the specific time-current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.
2. The following specific information shall also be shown on the coordination curves:

a. Device identifications.
b. Time and current ratio for curves.
c. ANSI damage points for each transformer.
d. Complete fuse curves.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum short circuit cutoff point.

3. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:

a. Device identification.
b. Tap, time delay, and instantaneous pickup.
c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
d. Fuse rating and type.
e. Ground fault pickup and time delay.

4. Provide electronic copies of the Captor Data files on two Compact Discs. Provide a cross reference between the data file names and the hard copy tables and reports.

2.2 ANALYSIS

A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified or not coordinated. Propose approaches to effectively protect the underrated equipment. Proposed major corrective modifications will be taken under advisement by the Owner and further instructions will be given.

B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

2.3 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

A. Accomplish necessary field settings, adjustments and minor modifications to conform with the study without additional cost to the Owner. (Examples of minor modifications

are trip sizes within the same frame, the time curve characteristics of induction relays, ranges etc.)

2.4 FIELD INFORMATION

A. Gather field information needed for the protective device study.

END OF SECTION 260573

SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following sections specify commissioning activities for this project:

01 91 13 – General Commissioning Requirements

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Lighting Control

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified Section 01 91 13, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that will be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Occupancy Sensors						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Daylight Dimming/Switching Control						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Lighting Control System						
Manufacturer Start-up Documentation						
Point to Point Verification		CxA Provided				
Contractor Checklist		CxA Provided				

Sample Contractor Checklist

Contractor Checklist
Occupancy Sensor Control

For each space with an occupancy sensor:

1. Indicate the Specified Type (ST), Specified Delay (SD) and Programmed Delay (PD).
2. Field Verify Type (FVT) as installed in space.
3. Field Verify Range (FVR) and sensitivity settings are appropriate for space configuration.
4. Field Measured Delay (FMD): Leave space and measure and record the ACTUAL delay time to off and confirm as programmed.
5. Field Verify Switch (FVS) operation if applicable.

Space	ST OS/VS	SD Min.	PD Min.	FVT OS/VS	FVR OK	FMD Min.	FVS OK		RC Initial	CxA Initial	Note

ST = Specified Type (OS or VS) SD = Specified Delay (min) PD = Programmed Delay (min)
FVT = Field Verified Type, FVR = Field Verified Range/Sensitivity is appropriate for space, FMD = Field Measured Delay
FVS = Field Verified Switch operation if applicable

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

Daylight Dimming/Switching Sensor Calibration and Set-Up

Space	Specified FC	Configured FC	Sensitivity Adjusted?	Comment

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Lighting Control Panel Pont-to-Point Verification

PCG = Polarity, Continuity and Grounding verified

Panel	Relay	Zone Description	PCG	Sched. Set	On/Off Verified	Comment

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The draft versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These draft Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor will be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that will be conducted on this project. This table will be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table will be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A System Description	B Responsible Contractor	C Proposed Test Forms Received	D OK	E Testing Complete	F OK	G Notes
Occupancy Sensors						
Daylight Dimming/Switching						
Lighting Control System						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Lighting Control System (Controller w/Relay Panel)
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule-B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
C.3	CxA	Contractor	100%	N/A

Functional Tests:

1) Lighting Controls – Demonstrate and document the following:
   a) All features and functions of control panel
   b) On/Off control
   c) Battery operated emergency lighting on power failure
   d) Dimming control
   e) Manual overrides
   f) Scheduling programming
   g) Exterior photo eye or astrological clock function
   h) Light zoning and channel verification

Daylight Dimming/Switching Sensors
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule-B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
C.3	CxA	Contractor	100%	N/A

Functional Tests:

1) Daylight Dimming – Demonstrate and document the following:
   a) Operation of all features and functions
   b) Sensitivity range
   c) Light level control verification
   d) On, Off and By-Pass Functions

Occupancy Sensors
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule-B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
C.3	CxA	Contractor	100%	N/A

Functional Tests:

1) Occupancy Sensors – Demonstrate and document the following:
   a) Operation of all features and functions
   b) Sensitivity range
   c) Time delay setting
   d) On, Off and By-Pass Functions

PART 4 – SAMPLE FUNCTIONAL TEST DOCUMENTS

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that will be required from the contractor. These forms and procedures will be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor.** Schedule - B of Part 3 provides a full list of the functional tests that will be required to be executed by the contractor.

Sample Draft Functional Performance Test
Lighting System Control - Time of Day Functions

Procedures:

1. Place the system in the scheduled-on mode.
2. Verify all zones and associated luminaries are on.
3. Place the system into the unscheduled-on mode.
4. Verify all zones and associated luminaries are off.
5. Schedule each zone off then on individually for short period, one after the other.
6. Verify each zone turns off in sequence.
7. Schedule all zones and associated luminaries off into the scheduled-off mode.
8. Program zone over-ride timer for 5 minutes.
9. Select a zone station in each zone and place that zone into the over-ride mode and verify associated zone and luminaries turn on.
10. Allow over-ride timer to time out and verify each zone turns off.

Data Sheet

Zone:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Zone is in the scheduled-on mode – All ON								
Zone is in the scheduled-off mode – All OFF								
Zone sequences with schedule								
Systems with Override:								
Zone is in the scheduled-off mode - OFF								
Over-ride zone - ON								
Zone OFF after over-ride time out								
Test Pass/Fail								

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Testing Contractor:			
CxA Witness/Verification:			

Comments:

Sample Draft Functional Performance Test
Lighting System Control - Time of Day Functions with Photo Cell

Procedures:

1. Place the system in the scheduled-on mode with photo cell exposed to light.
2. Verify all zones and associated luminaries are off
3. Simulate dark conditions by blacking out photo cell.
4. Verify all zones and associated luminaries turn on.
5. Place the system in the scheduled-off mode with photo cell blacked out
6. Verify all zones and associated luminaries remain off.
7. Remove blackout from photo cell
8. Verify each zone and associated luminaries remain off.

Zone:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Zone is in the scheduled-on mode lit photo cell – All OFF								
Photo cell is blacked out – All ON								
Zone is in the scheduled-off mode photo cell dark – All OFF								
Photo cell blackout removed – All OFF								
Test Pass/Fail								

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Testing Contractor:			
CxA Witness/Verification:			

Comments:

Sample Draft Functional Performance Test
Occupancy Sensor Control

1. Verify and record occupancy delay time.
2. Verify wall switches (if applicable) are on.
3. Wait till rooms are unoccupied and lights are off.
4. Enter room and verify lights are activated.
5. Leave the room and measure time delay until lights go out.

Room:						
Occupancy delay time setting (minutes)						
Lights off when unoccupied, record time						
Lights come on when room is entered						
Lights off after time delay, record time						
Calculated actual delay time						
Delay time acceptable						

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Installing Contractor:			
GC Cx Coordinator:			

END OF SECTION 260800

SECTION 260923 – LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Occupancy and Daylighting Sensor Control
2. Stand alone occupancy sensor control

B. Control Intent – Control Intent includes, but is not limited to:

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zone.
3. Initial time switch settings
4. Task lighting and receptacle controls.

1.2 REFERENCES

A. Edit the following to include only those standards referenced elsewhere in this Section.

B. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org and www.ieee.org)

C. Underwriter Laboratories of Canada (ULC)

D. International Electrotechnical Commission (www.iec.ch)

E. International Organization for Standardization (ISO) (www.iso.ch):

F. National Electrical Manufacturers Association (NEMA)

G. WD1 (R2005) - General Color Requirements for Wiring Devices.

H. Underwriters Laboratories, Inc. (UL) (www.ul.com):

1. 916 – Energy Management Equipment.
2. 924 – Emergency Lighting

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with 0-10 volt control for ballasts (if applicable), single or dual relay controllers for switching control of ballasts and single relay application-specific plug load controllers.
2. Digital Occupancy DT Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR)

communications. Sensors shall be available in both flush ceiling mounting configurations and surface bracket mounting configurations.

3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications. Switch pushbuttons shall be configurable for zones or scenes as noted on drawings or in sequence of operations.
4. Digital Wall Occupancy DT Sensors – Self-configuring digitally addressable and calibrated occupancy sensor with one or two pushbuttons and two-way active infrared (IR) communications. Unit shall be furnished for flush wall box installation and pushbuttons shall be configurable for zones or scenes as noted on drawings or in sequence of operations.
5. Digital Photosensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.
6. Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and stored occupancy sensor settings. Unit must indicate confirmation of commands sent to system devices. Computer software must also be available to customize room settings.
7. Where specified handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
8. Where specified to interface with other systems or equipment the system shall be furnished with input/output control modules to provide a contact closure based on the depressing of a system pushbutton, or activation of a command from the network Segment Manager.
9. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
10. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS).
11. Wallbox Dual Technology Sensors – Furnish line voltage wall box sensors for smaller areas where noted on plans. Sensor shall be furnished for 120/277V operation and shall utilize the principals of Dual Technology sensing. Unit shall also include dip switch setting for specific space configuration and allowing for a selectable manual on feature. Dip switches shall be hidden from view.
12. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.4 LIGHTING CONTROL APPLICATIONS

A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:

1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for

any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Bi-Level Lighting – Provide multi-level controls where shown on drawings
3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
4. Daylit Areas – All luminaries within daylighting zones as defined in the Washington e Energy Code (the daylit zones) shall be controlled separately from luminaires outside of daylit zones. Luminaires closest to the daylight aperture shall be controlled separately from luminaires farther from the daylight aperture, within the daylight zones.
5. Daytime set points for total ambient illumination (combined daylight and electric light) level that initiate dimming shall be programmed to be not less than 125% of the nighttime maintained designed illumination levels.
6. Multiple-leveled dimmed or switched daylight harvesting controls may be utilized for areas as marked on drawings.
7. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

B. Additional controls.

1. Provide occupancy/vacancy sensors for any enclosed office, conference room, meeting room, and training room. For spaces with multiple occupants or where line-of-sight may be obscured, provide ceiling- or corner-mounted with manual-on switches. Where noted on drawings smaller spaces may be specified with line voltage wall switch style occupancy sensors.
2. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space.

1.5 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
2. Scale drawings indicating panel locations, sensors, switches, bridges and segment manager. Drawing should show MSTP network wiring and local CAT5 wiring between devices. Relay and device schedules shall be included.
3. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.
2. Prove that the sensor is suitable for the proposed application.

1.6 QUALITY ASSURANCE

A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

1.7 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.8 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.9 MAINTENANCE

A. Spare Parts:

1. Provide

a. Switching Controllers – 2
b. Dimming Controllers – 4
c. Wall Switches – 4 button – 10
d. Digital Photocell – 4
e. Digital Occupancy Sensor – 6
f. Wall Box Occupancy Sensor – 6
g. Relays – Per Schedules

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. WattStopper or Douglas Controls

2.2 SINGLE / DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

A. Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled;

B. WattStopper DW-100, DW-200, DW-103, DW-203.

2.3 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR (DLM SYSTEM)

A. Wall or ceiling mounted (as indicated) DT dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton programming for the following variables:

   a. Sensitivity – 0-100% in 10% increments
   b. Time delay – 1-30 minutes in 1 minute increments
   c. Test mode – Five second time delay
   d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
   f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. One or two RJ-45 port(s) for connection to DLM local network.
3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
4. Device Status LEDs including:

   a. PIR Detection
   b. Ultrasonic detection
   c. Configuration mode.
   d. Load binding

5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMDX, LMDC

2.4 DIGITAL WALLBOX MOUNTED OCCUPANCY SENSOR (DLM SYSTEM)

A. Wallbox mounted DT dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton programming for the following variables:

    a. Sensitivity – 0-100% in 10% increments
    b. Time delay – 1-30 minutes in 1 minute increments
    c. Test mode – Five second time delay
    d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    e. Walk-through mode
    f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. Two RJ-45 port(s) for connection to DLM local network.
3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
4. Device Status LEDs including:

    a. PIR Detection
    b. Ultrasonic detection
    c. Configuration mode
    d. Load binding

5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

E. WattStopper product numbers: LMDW. Stainless plate

2.5 DIGITAL WALL SWITCHES (DLM SYSTEM)

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Red configuration LED on each switch that blinks to indicate data transmission.
4. Blue Load/Scene Status LED on each switch button with the following characteristics:

    a. Bi-level LED
    b. Dim locator level indicates power to switch
    c. Bright status level indicates that load or scene is active

5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to Toggle, On only or Off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

E. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Gray color and stainless steel plate

2.6 HANDHELD REMOTE CONTROLS (DLM SYSTEM)

A. Battery-operated handheld switches in 1, 2 and 5 button configuration for remote switching or dimming control. Remote controls shall include following features:

B. Two-way infrared (IR) transceiver for line of sight communication

1. Communicate with DLM local network within up to 30 feet.
2. Blue LED on each button confirms button press.
3. Load buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
4. Inactivity timeout to save battery life.

C. A wall mount holster and mounting hardware shall be included with each remote control

D. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.7 ROOM CONTROLLERS (DLM SYSTEM)

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Device Status LEDs to indicate:

    a. Data transmission
    b. Device has power
    c. Status for each load
    d. Configuration status

4. Quick installation features including:

    a. Standard junction box mounting
    b. Quick low voltage connections using standard RJ-45 patch cable

5. Plenum rated
6. Network Bridge for BACnet MS/TP communications (LMRC-3xx).
7. Manual override and LED indication for each load
8. Dual voltage (120/277 VAC, 60 Hz)
9. Zero cross circuitry for each load.

B. Switching On/Off Room Controllers (SRC)shall include:

1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports
4. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

    a. One relay configuration only
    b. Automatic-ON/OFF configuration

5. WattStopper product numbers: LMRC-101, LMRC-102, LMPL-101

C. Dimming Room Controllers (DRC)shall include:

1. Real time current monitoring.
2. One, two or three relay configuration.
3. Efficient 250 mA switching power supply.
4. Four RJ-45 DLM local network ports.
5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
6. Network Bridge for BACnet MS/TP communications (LMRC-3xx).
7. The following dimming attributes may be changed or selected using a wireless configuration tool:

    a. Establish preset level for each load from 0-100%
    b. Set high and low trim for each load
    c. Set lamp burn in time for each load up to 100 hours

8. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

a. One relay configuration only
b. Automatic-ON/OFF configuration

D. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.

2.8 DIGITAL LOW VOLTAGE CONTROL PANELS (LOW VOLTAGE RELAY PANELS - LVR)

A. System panels shall be provided in locations and capabilities as indicated on plans and in schedules. Panels shall be configured for surface or flush mounting as shown and shall be furnished in NEMA 1 enclosures with hinged lockable covers unless otherwise noted. Dividers shall be provided between line and low voltage compartments of the panel. Where different voltages or emergency circuits are present in the same panel, additional dividers shall be installed.

B. Panel interior shall be furnished factory assembled and listed for field installation. Interior shall be furnished complete including intelligence boards, power supply, DIN rails, individually replaceable latching type HDR relays and the following added features:

1. IR ports for panel setup via the DLM system LMCT-100 configuration tool.
2. Override pushbuttons for each relay and LED indicators to indicate relay status.
3. Panel shall be capable of running the following events whether stand alone or over the MSTP network.

    a. Scheduled events
    b. Photocell events
    c. Up to 99 control groups
    d. Local or global occupancy sensor inputs
    e. Local or global switch inputs

4. Local CAT5e network segments:

    a. Support for 2 CAT5e DLM device networks supporting 250MA at 24VDC. Up to 60 LMSW Switches or 30 LMDC Sensors or a combination thereof.
    b. Additional current is available by adding power supplies
    c. Each local network has 2 RJ45 ports available in the panel

5. Control both interior and exterior loads
6. .Relays are single pole mechanical latching with the following ratings:

    a. 20 amp ballast at 277V
    b. 20 amp ballast at 347V
    c. 20 amp tungsten at 120V
    d. 20 amp resistive at 347V
    e. 1.5HP motor rating at 120V
    f. 14,000 amp short circuit current rating (SSCR) at 347V

7. Manual override and LED indication for each load
8. Dual voltage (120/277 VAC, 60 Hz)
9. Relays tested to minimum of 300,000 operations.
10. Zero cross circuitry for each load.

C. BACnet based communication shall be RS485 MSTP using BACnet Protocol as follows:

1. Each panel shall have an individual device ID

2. Every device ID on the local panel network shall be visible and shall communicate over the network.
3. Relays shall be controlled as binary output objects in the instance of 1-48 the state of each relay shall be readable and writable via the BAS using object present value property
4. The description property for all objects shall be writable via the network and shall be saved in Non-volatile memory within the panel.
5. Relays shall report their true on/off state as binary input objects in the same instance range of 1-48.
6. The BO an BV objects shall support BACnet priority array with a relinquish default of off and after hours respectively
7. Setup and commissioning of the panel shall not require manufacturer specific software or configuration tools of any kind. All configuration of the lighting control panel shall be preformed using standard BACnet objects or via the LMCT configuration tool.

D. Panel shall support digital wall switches with 1,2,3,4 or 8 buttons, they connect and communicate over the panels local CAT5e network. Switches shall have the following characteristics:

1. Single gang devices shall fit standard decora openings and use standard cover plates
2. LED indicator on each button for status and locator functions.
3. Concealed configuration button with LED indicator for binding buttons to relays, no software or computer shall be required.
4. Infrared window for use with the LMCT handheld two-way wireless configuration tool.
5. Selectable function mode per button shall be momentary toggle (on/off), on only or off only.
6. Removable button assembly for field color change or substitution of engraved buttons.
7. Two RJ-45 DLM local network ports for connections to panel or other switches/sensors.
8. Devices shall connect via open topology on the CAT5e digital network.
9. Digital Switches shall be Wattstopper LMSW series as indicated herein before and on drawings.

E. Panel shall support digital DT dual technology occupancy sensors; they connect and communicate over the panel's local CAT5e network. Sensors shall have the following characteristics:

1. Wall or ceiling mounted DT dual technology digital (passive infrared and ultrasonic) occupancy sensor.
2. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

    a. Digital calibration and pushbutton programming for the following variables:
    b. Sensitivity – 0-100% in 10% increments
    c. Time delay – 1-30 minutes in 1 minute increments
    d. Test mode – Five second time delay
    e. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    f. Walk-through mode
    g. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

3. One or two RJ-45 port(s) for connection to panel or other switches/sensors.
4. Devices shall connect via open topology on the CAT5e digital network.
5. Digital Switches shall be Wattstopper LMDC or LMDX series as indicated herein before and on drawings.

F. Schedule, Group, and Photocell Control of Relays

1. The lighting control panel shall support schedule, group, and photocell control functions via the network as configured in the Segment Manager controller or building automation system. The lighting control panel shall be fully compatible with building automation systems that are BACnet compliant. See related specification sections for additional information on interfacing the lighting control panel(s) to the building automation system.

G. Browser-Based Programming and Control

1. The digital Segment Manger shall be capable of hosting the schedule, photocell and group relay control functions for up to 96 LMCP series lighting control panels. Panels and devices shall be recognized and controllable via a browser based user interface in the system Segment Manager. The Segment Manager shall provide functionality to the panels as described later in this specification.

H. Wattstopper Product numbers: LMCP-8, LMCP-24, and LMPC-48.

2.9 DIGITAL PHOTOSENSORS (DLM SYSTEM)

A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B. Digital photosensors include the following features:

1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-10,000 footcandles (fc).
3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.

7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
8. Red configuration LED that blinks to indicate data transmission.
9. Blue status LED indicates test mode, override mode and load binding.
10. Recessed switch to turn controlled load(s) ON and OFF.
11. One RJ-45 port for connection to DLM local network.
12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Furnish mounting bracket for sensors located in drywall surfaces.

C. Closed loop digital photosensors include the following additional features:

1. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
3. Automatically establishes setpoints following self-calibration.
4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.
5. WattStopper Product Number: LMLS-400.

D. Open loop digital photosensors include the following additional features:

1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.

E. WattStopper Product Number: LMLS-500.

2.10 ROOM NETWORK (DLM Local Network)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
3. Push n’ Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor

configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

a. The DLM local network wiring shall connect controller to controller. In no case shall the controller network route through an occupancy sensor or wall switch

2.11 CONFIGURATIONS TOOLS (DLM SYSTEM)

A. A configuration tool facilitates optional customization of DLM local networks, and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting.
6. Adjust or fine-tune daylighting settings established during auto-commissioning and input light level data to complete commissioning of open loop daylighting controls.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.12 NETWORK BRIDGE (DLM SYSTEM)

A. The network bridge connects a DLM local network to a BACnet-compliant network for communication between rooms, panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication.

1. The network bridge may be provided as a separate module connected on the local network through an available RJ-45 port.
2. Provide Plug n' Go operation to automatically discover all room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:

a. Read/write the normal or after hours schedule state for the room
b. Read the detection state of the occupancy sensor
c. Read/write the On/Off state of loads
d. Read/write the dimmed light level of loads

e. Read the button states of switches
f. Read total current in amps, and total power in watts through the room controller
g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
h. Activate a preset scene for the room
i. Read/write daylight sensor fade time and say and night setpoints
j. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
k. Set daylight sensor operating mode
l. Read/write wall switch lock status

B. WattStopper product numbers: LMBC-300

2.13 SEGMENT MANAGER (DLM SYSTEM)

A. The Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser. Each segment manager shall have support for one, two or three segment networks as required and allow for control of a maximum of 40 local networks (rooms) and/or a combination of lighting control panels and bridges per segment network. Each segment shall support up to 300 DLM device addresses. Panels shall account for number of bridges and devices as follows:

1. 8 circuit panel = 3 Bridges and 20 Devices
2. 24 circuit panel = 5 Bridges and 30 Devices
3. 48 circuit panel = 7 Bridges and 40 Devices

B. Operational features of the Segment Manager shall include the following:

1. Connection to PC or LAN via standard Ethernet TCP/IP.
2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser.
3. Log in security capable of restricting some users to view-only or other limited operations.
4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.
5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hour’s operation.
7. Ability to set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hour’s mode of operation.
8. Support for up to 100 unique schedules with up to 4 time events per day.
9. Ability to group rooms and loads for common control by schedules, switches or network commands.
10. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
11. Facilities with networks exceeding the requirements established for the LMSM-603 shall be expanded with the use of native BACnet routers.
12. Provide segment manager with factory NEMA 1 enclosure and power supply.

13. An internet connection shall be made available for the Segment Manager for Owners remote access to the system.
14. Provide seamless integration with the BAS via BACnet IP. Integration to the BAS shall be through the use of export tables.

C. WattStopper Product Numbers: LMSM-201 for a single segment, LMSM-603 for three segments.

PART 3 - EXECUTION

3.1 INSTALLATION

A.

A. When using wire for connections other than the DLM local network (Cat 5e with RJ-45 Connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements.

B. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

C. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

D. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

E. Re-calibration – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-calibration activity. A 2 hour follow up training will be done on this visit to retrain and answer questions from owners technicians.

3.2 FACTORY START-UP

A. Upon completion of the installation, the system shall be started by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the desired system start-up and adjustment date.

C. Upon completion of the system start-up the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system on separate visit from any work by the technician.

D. Upon completion of the system start-up the factory-authorized technician shall provide the proper training to the building occupants on the use and expectations of the system.

END OF SECTION 260923

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SECTION 261200 – PADMOUNT TRANSFORMERS

PART 1 - GENERAL

1.1 GENERAL INFORMATION

A. This specification covers the electrical and mechanical characteristics of Three-Phase Step-Down Pad-Mounted Distribution Transformers.

B. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI and NEMA standards.

1. C57.12.00 - IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. C57.12.26 - IEEE Standard for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors (34500GrdY/19920 Volts and Below; 2500 kVA and Smaller).
3. C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.
4. C57.12.34 - IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller. (issued in March 2005 - combines C57.12.22 and C57.12.26)
5. C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
6. C57.91 - Guide for Loading Mineral-Oil-Immersed Transformers.

1.2 Vault under transformers: Utility Vault #774LA or 644LA with custom top.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Cooper Power Systems, ABB, Square D, GE, Eaton, Siemens or approved equal

B. DOE2016 Rated

2.2 RATINGS

A. The transformer *shall be designed in accordance with this specification and the kVA rating shall be as shown on drawings. Primary voltage is 4.16 KV an secondary voltage is 480Y/277 Volt and a second transformer with 208Y/120 Volt, 3 phase, 4 wire. Transformer shall be delta/wye type with 5 legged core. (Addendum Three)* ~~shall be designed in accordance with this specification and the kVA rating shall be as shown on drawings. Primary voltage is 4.16 KV an secondary voltage is 480Y/277 Volt and a second transformer with 208Y/120 Volt, 3 phase, 4 wire. Transformer shall be wye/wye type with 5 legged core.~~

B. The primary voltage, configuration, and the basic lightning impulse insulation level (BIL) shall be 95 KV

C. The secondary voltage, configuration, and the basic insulation level (BIL) of the secondary voltage shall be 30 KV

D. The transformer shall be furnished with full capacity high-voltage taps. The taps shall be +/- 2 - 2½% above and below nominal voltage. The tap changer switch shall be an externally operated switch with a hotstick-operable handle. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 3.3 of ANSI C57.12.26. Taps shall be provided on the higher voltage of dual voltage primary units.

E. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 55°C

F. The percent impedance voltage, as measured on the rated voltage connection, shall be 5.75%. For target impedances, the tolerance on the impedance shall be +/- 7.5% of nominal value for impedance values greater than 2.5%.

2.3 HIGH VOLTAGE BUSHINGS AND TERMINALS

A. Bushing Configuration:

1. 15 KV LOOP FEED DEADFRONT: The transformer shall be provided with six (6) high voltage bushings with inserts and termination for ~~200A load break~~ *600A load break (Addendum Three)* elbow connectors. The minimum dimensions of ANSI C57.12.34 for loop feed configurations. The bushing heights shall be in accordance with Figure 3 minimum dimensions of ANSI C57.12.34.
2. Provide lightning arrestors in loop feed well.

2.4 SECONDARY VOLTAGE BUSHINGS AND TERMINALS

A. Bushing Style:

1. For voltages less than 700 Volts: The transformer shall be provided with tin-plated spade-type bushings for. The spacing of the connection holes shall be 1.75” on center, per ANSI C57.12.34 figure 13.

B. Bushing supports shall be provided for units requiring 10 or more connection holes. Bushing supports shall be attached to the cabinet sidewalls; tank-mounted support mountings are not acceptable.

C. Bushing Configuration:

1. The transformer shall be provided with bushings in a staggered arrangement in accordance with Figure 11a minimum dimensions of ANSI C57.12.34.

2.5 TRANSFORMER PROTECTION AND SWITCHING

A. Overcurrent Protection: *Bayonet with current limiting fuses or VFI: The high-voltage overcurrent protection scheme provided with the transformer shall be an externally*

removable loadbreak expulsion Bay-O-Net fuse assembly with a flapper valve to minimize oil spillage. The bayonet fuses shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 A. Or use VFI. (Addendum Three) ~~Bayonet with current limiting fuses: The high-voltage overcurrent protection scheme provided with the transformer shall be an externally removable loadbreak expulsion Bay-O-Net fuse assembly with a flapper valve to minimize oil spillage. The bayonet fuses shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 A.~~

B. Overvoltage Protection: The overvoltage protection scheme provided with the transformer shall protect the high-voltage winding.

1. With DEADFRONT bushings: (150 kV BIL, for voltages up to 22 kV delta and 35 kV grounded wye). Externally mounted, Distribution Class M.O.V.E. Deadfront elbow arresters shall be supplied. (Example: Cooper Power Systems Catalog section 235-55 and 235-65)

C. With DEADFRONT Loopfeed bushings: Externally mounted, Distribution Class M.O.V.E. Deadfront elbow arresters shall be supplied. (Example: Cooper Power Systems Catalog section 235-55 and 235-65

D. With integral selector switch allowing section of Feeder 1 or Feeder 2 to feed the transformer.

2.6 GENERAL DESIGN

A. Core and coil: The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.

B. Dielectric fluid: The dielectric coolant shall be listed less-flammable fluid meeting the requirements of National Electrical Code® Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-1997), Section 15. The dielectric coolant shall be readily and completely biodegradable per EPA OPPTS 835.3100. The base fluid shall be 100% derived from edible seed oils with performance enhancing additives. The fluid shall result in zero mortality when tested on trout fry per OECD G.L. 203 and be non-bioaccumulating. The fluid shall be published under US EPA Environmental Technology Verification (ETV) requirements, and tested for compatibility with transformer components. The fluid shall be Factory Mutual Approved, UL® Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOVK), Envirotemp® FR3® fluid.

C. Tank and Cabinet Enclosure

1. The high-voltage and low-voltage compartments, separated by a metal barrier, shall be located side-by-side on one side of the transformer tank. When viewed

from the front, the low-voltage compartment shall be on the right. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. There shall be one or more additional fastening devices that must be removed before the high-voltage door can be opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304 or the equivalent.

2. A recessed, captive, hex-head bolt that meets the dimensions per ANSI C57.12.28 shall secure all access doors.
3. The enclosure integrity of the tank and cabinet shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test.
4. The compartment depth shall be in accordance with C57.12.34, unless additional depth is specified.
5. The tank base must be designed to allow skidding or rolling in any direction. Lifting provisions shall consist of four lifting lugs welded to the tank.
6. The tank shall be constructed to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15 psig pressure relief valve with a minimum flow rate of 35 SCFM.
7. The tank and cabinet coating shall meet all the requirements of ANSI C57.12.28 including:

    a. Salt Spray Test
    b. Crosshatch Adhesion Test
    c. Humidity Test
    d. Impact Test
    e. Oil Resistance Test
    f. Ultraviolet Accelerated Weathering Test
    g. Abrasion Resistance - Taber Abraser

8. The exterior of the unit shall be painted Munsell 7GY3.29/1.5 green, in color. The cabinet interior and tank face shall be painted gray for ease of viewing the inside the compartment.
9. The tank shall be complete with an anodized aluminum laser engraved nameplate. This nameplate shall meet Nameplate B per ANSI C57.12.00.

2.7 ACCESSORIES

A. The following accessories shall be provided:

1. Bolted main tank cover (1000 kVA & below)
2. Welded main tank cover with bolted handhole (1500 kVA & above)
3. 1.0” upper fill plug
4. 1.0” drain plug in LV compartment (500 kVA & below)
5. 1.0” drain valve w/ sampling device in LV compartment (750 kVA & above)
6. Automatic pressure relief valve
7. Metal drip shield (when bayonets specified)
8. Ground provisions per C57.12.34 section 9.11.
9. Meet NEMA TR-1 sound levels

10. Liquid level gauge
11. Dial-type thermometer gauge
12. Pressure vacuum gauge
13. 1.0" drain valve w/ sampling device in (LV or HV) compartment (500 kVA & below)
14. Upper fill valve
15. Ground connectors
16. Danger high voltage warning signs
17. Non-PCB decal
18. Seismic zone 3 and 4 tank anchoring
19. Harmonic resistant K-factor design, K=13
20. Factory Mutual (FM) Approved transformer (for NEC Code-listed installations on, near, or inside of buildings)
21. UL Listed and Classified transformer (for NEC Code-listed installations on, near, or inside of buildings) per UL XPLH
22. UL Listed transformer (certifying compliance with ANSI standards only) per UL XPLH

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per the manufacturer's requirements

B. Test grounding and all connections

3.2 SHIPPING

A. Units 1000 kVA and below shall be palletized. Units 1500 kVA and larger shall be loaded and unloaded with overhead cranes, so a pallet is not to be provided for these transformers.

3.3 TESTING & TOLERANCES

A. All units shall be tested for the following:

1. No-Load (85°C) losses at rated current
2. Total (85°C) losses at rated current
3. Percent Impedance (85°C) at rated current
4. Excitation current (100% voltage) test
5. Winding resistance measurement tests
6. Ratio tests using all tap settings
7. Polarity and phase relation tests
8. Induced potential tests
9. Full wave and reduced wave impulse test

B. In addition, the manufacturer shall provide certification for all design and other tests listed in C57.12.00, including verification that the design has passed short circuit criteria per ANSI C57.12.00 and C57.12.90.

C. IF THE TRANSFORMER HAS EVALUATED LOSSES, The no-load losses of a transformer shall not exceed the specified no-load losses by more than 10%, and the total losses of the transformer shall not exceed the specified total losses by more than 6%.

3.4 DATA WITH PROPOSAL

A. The following data shall be submitted with the proposal:

1. Core losses
2. Winding losses
3. Percent Impedance
4. Typical record drawings
5. Approval drawings (furnished at time of order)
6. Final record drawings (furnished at time of shipment)

END OF SECTION 261200

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SECTION 262413 – SWITCHBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Main Switchboard – Furnish and install the Service Entrance switchboard(s) as herein specified and shown on the associated electrical drawings.

B. Distribution Switchboard – Furnish and install the Distribution Switchboard(s) as herein specified and shown on the associated electrical drawings.

C. Selective Coordination: see section 260573for selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

1.2 REFERENCES

A. The switchboard(s) and overcurrent protection devices referenced herein are designed and manufatured according to the following appropriate specifications.

B. ANSI/NFPA 70 - National Electrical Code (NEC).

C. ANSI/IEEE C12.16 - Solid State Electricity Metering.

D. ANSI C57.13 - Instrument Transformers.

E. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

F. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681.

G. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.

H. NEMA PB 2.2 - Application Guide for Ground Fault Protective Devices for Equipment.

I. UL 50 - Cabinets and Boxes.

J. UL 98 - Enclosed and Dead Front Switches.

K. UL 489 - Molded Case Circuit Breakers.

L. UL 891 - Dead-Front Switchboards.

M. UL 943 - Ground Fault Circuit Interrupters.

N. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

1.3 SUBMITTALS

A. Shop Drawings shall indicate front and side enclosure elevations with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; equipment schedule; and switchboard instrument details.

1.4 QUALIFICATIONS

A. To be considered for approval, a manufacturer shall have specialized in the manufacturing and assembly of switchboards for at least fifty (50) years.

B. Furnish products listed by Underwriters Laboratories Incorporated and in accordance with standards listed in Article 1.03 - References.

C. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

1.5 DELIVER, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.7 MAINTENANCE MATERIALS

A. Provide installation and maintenance instructions with each switchboard. Instructions are to be easily identified and affixed within the incoming or main section of the line-up.

1.8 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Shall be Square D Company, General Electric, Eaton/CutlerHammer, or Siemens.

2.2 SWITCHBOARD – GENERAL

A. Utility Metering Compartment: The utility current transformer compartment shall comply with the local utility construction specifications.

B. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit current rating as shown on drawings.

C. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

D. Enclosure: Type 1 - General Purpose.

1. Sections shall be aligned front and rear.
2. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
3. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
4. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
5. Top and bottom conduit areas shall be clearly indicated on shop drawings.

E. Nameplates: Provide 1 inch high x 3 inches engraved laminated (Gravoply) nameplates for each device. Furnish black letters on a white background for all voltages.

F. Bus Composition: Shall be plated copper or plated aluminum. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

G. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.

2.3 SWITCHBOARD – INCOMING MAIN SECTION DEVICES

A. Main Circuit Breaker(s)

1. Electronic trip molded case full function 100% rated circuit breaker(s) with ground fault protection.

a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
b. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule.
c. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
d. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
e. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
f. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules.

2.4 SWITCHBOARD – DISTRIBUTION SECTION DEVICES

A. Group mounted circuit breakers where required for coordination.

1. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
2. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
3. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.
4. Line-side circuit breaker connections are to be jaw type.
5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
6. Thermal magnetic molded case circuit breakers through 2500A.

    a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.

7. Circuit protective devices shall be molded case circuit breaker(s).
8. Provide electronic trip type per below as needed for coordination.

B. Individually Mounted circuit breakers greater than 1200A

1. Electronic trip molded/insulated case full function 100% rated circuit breaker(s) through 2000A.

    a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
    b. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule.
    c. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
    d. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
    e. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
    f. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules.

2.5 METERING (CUSTOMER)

A. Manufacturers:

1. Square D
2. PowerLogic

B. The switchboard shall be metered using:

1. Square D Type PM 600 Digital Power Meter with 0.25% accuracy with the following features:

    a. A, V, kW, kVAR, kVA, PF, F, kWh, kVARh, kVAh, KYZ, RS-485 communications

C. Provide pulse initiator for connection to the DDC system

2.6 METERING TRANSFORMERS

A. Manufacturer: Shall be Square D Company.

B. Current Transformers: ANSI C57.13; 5 ampere secondary.

C. Voltage Transformers: ANSI C57.13; 120 V single secondary, (Not required for type PM meters).

2.7 SURGE PROTECTOR

A. Provide 30Amp – 3pole circuit breaker connected to Innovative Technology #PTX-160 surge protector.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written guidelines, the NEC, and local codes.

3.3 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure, using a Megger, the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000 VDC; minimum acceptable value for insulation resistance is 1 megohms. NOTE: Refer to manufacturer's literature for specific testing procedures.

C. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque values.

D. Physically test key interlock systems to check for proper functionality.

E. Test ground fault systems by operating push-to-test button.

3.4 HOUSEKEEPING PAD

A. Provide minimum 3-inch housekeeping pad under all switchboards. Extend 3-inches beyond footprint.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturers specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Architect/Engineer.

3.6 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION 262413

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SECTION 262416 – PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Panelboard - Furnish and install lighting and appliance panelboard(s) as specified herein and where shown on the associated drawings.

B. Selective Coordination: see section 260573 for selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

C. Contractor shall note that drawings allow and may show shared neutrals for circuits. Contractor shall comply with NEC 210.4B, which requires either separate neutrals or a disconnecting means that disconnects all ungrounded conductors at the point where the circuit originates. This requires the contractor to provide breaker ties or 3 pole breakers for all groups of 3 circuits run with shared neutral in the field as grouping is frequently changed. Contractor shall include this in the contract. No additional payments will be made for this code requirement.

1.2 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

A. NEMA PB 1 – Panelboards

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 – Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

J. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers

K. Federal Specification W-P-115C - Type I Class 1

L. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

M. NFPA 70 - National Electrical Code (NEC)

N. ASTM - American Society of Testing Materials

1.3 SUBMITTAL AND RECORD DOCUMENTATION

A. Approval documents shall include drawings. Drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

1.4 QUALIFICATIONS

A. Company specializing in manufacturing of panelboard products with a minimum of fifty (50) years documented experience.

B. Panelboards shall be manufactured in accordance with standards listed Article 1.2 - REFERENCES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspect and report concealed damage to carrier within their required time period.

B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.6 OPERATIONS AND MAINTENANCE MATERIALS

A. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.7 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Shall be Square D Company, General Electric, Eaton/Westinghouse, or Siemens.

B. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternate manufacturer meets all aspects of the specification herein.

2.2 480Y/277 VOLT PANELBOARD

A. NF

1. Interior

a. Shall be type NF panelboard for 480Y/277 Vac maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum for main breaker panelboards and not to exceed 800 amperes for main lug panelboards.
b. Minimum Short Circuit Rating: As shown on drawings. Minimum size shall be 14,000 AIC rms symmetrical amperes at 480Y/277 Vac.
c. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated copper or aluminum. Bussing rated for 600 and 800 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
d. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
e. A solidly bonded copper equipment ground bar shall be provided.
f. Split solid neutral shall be plated and located in the mains compartment up to 250 amperes so all incoming neutral cable may be of the same length.
g. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
h. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
i. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 125A interiors shall be vertically mounted. Main circuit breakers over 125A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
j. Interior phase bus shall be pre-drilled to accommodate field installable options. (i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs)
k. Interiors shall accept 125 ampere breakers in group mounted branch construction.

2. Main Circuit Breaker (where shown)

a. Shall be Square D type circuit breakers.
b. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
d. Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
g. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.
h. Provide electronic trip and I-Line type panel where required for coordination.

3. Branch Circuit Breakers

a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
d. There shall be two forms of visible trip indication. The circuit breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.
e. The exposed faceplates of all branch circuit breakers shall be flush with one another.

f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.

g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.

h. Breaker shall be UL Listed with the following ratings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), and (15-20A) Switch Duty (SWD)

i. Provide electronic trip and I-Line type panel where required for coordination.

4. Enclosures

a. Type 1 Boxes
   1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
   2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
   3) Box width shall not exceed 26” wide.

b. Type 1 Fronts
   1) Front shall meet strength and rigidity requirements per UL 50 standards. Shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   2) Fronts shall be hinged 1-piece with door (door in door). Mounting shall be as indicated on associated drawings.
   3) Panelboards rated 250 amperes and below shall have MONO-FLAT fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 250 amperes shall have vented fronts with concealed door hinges. Doors on front shall have rounded corners; edges shall be free of burrs.
   4) Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.

c. Type 3R, 5, and 12 where indicated.
   1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
   3) Maximum enclosure dimensions shall not exceed 21” wide and 9.5” deep.

2.3 208/120 VOLT AND 240/120 VOLT PANELBOARD

A. NQOD

1. Interior
2. Shall be type NQOD panelboard rated for 240 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum.

    a. Minimum short circuit current rating: as shown on drawings but minimum 10,000 in rms symmetrical amperes at 240 Vac.
    b. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated copper or aluminum. Bussing rated for 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
    c. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
    d. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided mounted on insulators.
    e. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. Where indicated UL Listed panelboards with 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
    f. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
    g. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
    h. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be vertically mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

3. Main Circuit Breaker where indicated.

    a. Shall be Square D type circuit breakers.
    b. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and

magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.

c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

d. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.

e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.

f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.

g. The circuit breakers shall be UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

h. Provide electronic trip and I-Line type panel where required for coordination.

4. Branch Circuit Breakers

a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated drawings.

b. Molded case branch circuit breakers shall have bolt-on type bus connectors.

c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.

e. The exposed faceplates of all branch circuit breakers shall be flush with one another.

f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.

g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.

h. Provide electronic trip and I-Line type panel where required for coordination.

5. Enclosures

a. Type 1 Boxes
1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
3) Box width shall be 20” wide maximum unless approved.

b. Type 1 Fronts
1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) Fronts shall be hinged 1-piece with door (door in door). Mounting shall be as indicated on associated drawings.
3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

c. Type 3R, 5, and 12 where indicated.
1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
3) Maximum enclosure dimensions shall not exceed 21” wide and 6.5” deep.

6. Provide Innovative Technology PTE-080 surge protector or TPS LP series, 30/3 breaker with maximum 8” lead length at all 120/208V panels.

2.4 DISTRIBUTION PANELBOARDS

A. I-LINE Circuit Breaker Distribution Panelboard

1. Interior

a. Shall be Square D I-LINE type rated 600 Vac or 250 Vdc maximum. Continuous main current ratings as indicated on associated drawings not

to exceed 1200 amperes maximum. Where distribution board noted abovge 1200 amperes provide switchboard. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.

b. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated drawings not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230.VI and VII.

c. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

d. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing rated 100 through 600 amperes shall be plated copper or aluminum. Bussing rated 800 amperes and above shall be plated copper. Bus bar plating shall run the entire length of the bus bar. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners.

e. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breakers through 800 amperes shall be vertically mounted. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.

f. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided.

g. Solid neutral shall be equipped with a full capacity bonding strap for service entrance applications. Where indicated UL Listed panelboards with 200% rated solid neutrals shall have plated copper neutral bus for non-linear load applications. Gutter-mounted neutral will not be acceptable.

h. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be displayed on the interior or in a booklet format. Leveling provisions shall be provided for flush mounted applications.

2. Group mounted circuit breakers through 1200A

a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.

b. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

c. Circuit breakers equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.

d. Line-side circuit breaker connections are to be jaw type.
e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
f. Provide electronic trip and I-Line type panel where required for coordination.

3. Thermal magnetic molded case circuit breakers

a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.
b. Circuit protective devices shall be Square D molded case circuit breakers. Circuit breakers shall be rated as shown on schedules. Ampere ratings shall be as shown on the drawings.
c. Provide electronic trip and I-Line type panel where required for coordination.

4. Enclosures

a. Type 1 Boxes
   1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Zinc-coated galvannealed steel will not be acceptable.
   2) Boxes shall have removable blank end walls and interior mounting studs. Interior support bracket shall be provided for ease of interior installation.
   3) Maximum enclosure dimensions shall be 44” wide and 9.5” deep.
b. Type 1 Trim Fronts
   1) Trim front steel shall meet strength and rigidity requirements per UL 50 standards. Shall have an ANSI 49 medium gray enamel electrodeposited over cleaned phosphatized steel.
   2) Trim front shall be hinged 1-piece with door available in flush or surface mount as indicated. Trim front door shall have rounded corners and edges free of burrs. A clear plastic directory cardholder shall be mounted on the inside of the door.
   3) Locks shall be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
c. Type 3R, 5, and 12 where indicated.
   1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   2) All doors shall be gasketed and be equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners. A clear plastic directory cardholder shall be mounted on the inside of door. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.
   3) Maximum enclosure dimensions shall not exceed 44” wide and 14.5” deep.

B. Housekeeping Pad: When floor mounted proved 3-inch housekeeping pad minimum 3-inches beyond footprint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

3.2 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION 262416

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SECTION 262653 – ELECTRIC VEHICLE CHARGING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes EV charging equipment that provides Level 2 EV charging.

1.3 DEFINITIONS

A. EV: Electric vehicle.

B. EV Cable: The off-board cable containing the conductor(s) to connect the EV power controller to the EV that provides both power and communications during energy transfer.

C. EV Charger or EV Charging Equipment: See "EVSE".

D. EV Connector: A conductive device that, when electrically coupled to an EV inlet, establishes an electrical connection to the EV for the purpose of power transfer and information exchange. This device is part of the EV coupler.

E. EV Coupler: A mating EV inlet and connector set.

F. EV Inlet: The device in the vehicle into which the EV connector is inserted, and a conductive connection is made for the transfer of power and communication. This device is part of the EV coupler.

G. EVSE: Electric Vehicle Supply Equipment. It includes the EV charging equipment and conductors, including the ungrounded, grounded, and equipment grounding conductors and EV cables, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for transferring energy between the premise wiring and the EV.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. In the current version of LEED, EV chargers

B. Shop Drawings for EV charging equipment.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of mounting assemblies for EV charging equipment.
4. Include diagrams for power, signal, and control wiring.
5. Include verification of wireless communications service at each location of EV charging equipment.

C. Product Schedule: For EV charging equipment.

D. Qualifications Data: Installer must be factory authorized service representative.

E. Seismic Qualification Certificates from manufacturer. Describing basis for certificate, mounting requirements to meet certification.

F. Warranty information.

1.5 CLOSEOUT SUBMITTALS

A. Operations and Maintenance Data: For EV charging equipment to include in operations and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Online training and help documentation.
2. Station activation sticker.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Comply with UL 2231-1. UL 2231-2, UL 2594, and NEC Article 625.

D. Comply with SAE J1772.

E. Comply with FCC Part 15 Class A.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of EV charging units that fail(s) in materials or workmanship within specified warranty period for 1 year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide ChargePoint; CT4000 family of electric vehicle charging. Schneider Electric EVSE is also approved.

1. Dual Output Unit consist of

a. Dual Output Gateway CT4021-GW1
b. Concrete mounting kit CT4001-CCM
c. Prepaide commercial cloud plan 1 year CPCLD-COMMERCIAL-1
d. Activation CPSUPPORT-ACTIVE
e. Site validation CPSUPPORT-SITEVALID
f. 1 year warrenty CT-4000-ASSURE

2. Single Output Unit cosist of

a. Single Output Gateway CT4011
b. Concrete mounting kit CT4001-CCM
c. Prepaide commercial cloud plan 1 year CPCLD-COMMERCIAL-1
d. Activation CPSUPPORT-ACTIVE
e. Site validation CPSUPPORT-SITEVALID
f. 1 year warrenty CT-4000-ASSURE

B. Source Limitations: Obtain EV charging equipment from a single manufacturer.

2.2 EV CHARGING EQUIPMENT DESCRIPTION.

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. ADA compliant.

D. Metering +/- 2 percent from 2 percent to full scale of output (30 A).

E. EV Charging Equipment Mounting: Bollard.

F. Enclosures:

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.
b. Aluminum and UV-resistant plastic.
c. Paint and Anodized.
d. Charging components protected by security screws.
e. Charging connectors in locking holsters.
f. Meter, modem, and CPU, tamper resistant.

G. EV Cable and Connectors:

1. SAE J1772 connector.
2. One and Tow connectors with locking holster.
3. 18-foot (5.5 m)]cable with cable management system.

H. Status Indicators:

1. LEDs to indicate power, charging, charging complete, system status, faults, and service.

I. Display Screen:

1. VGA-resolution, daylight-viewable LCD screen with UV protection. Daylight readable and fingerprint resistant.
2. Displays power, charging, charging complete, remote control, system status, faults,
3. payment and pricing details, and service.

J. Networking:

1. WAN Communications: Cellular GSM/GPRS and CDMA.
2. LAN Communications: 2.4 GHz Wi-Fi 802.11b/g/n.
3. Capable of remote configuration and reporting.

K. Payment System:

1. RFID (ISO 15693, ISO 14443), NFC, Contactless credit card reader.
2. PCI (Payment Card Industry) compliant.
3. Capable of remote control and authorization including mobile phone application or toll free phone number.

L. L. Charging Network: Compatible with the ChargePoint EV charging network.

1. Multiple units shall independently connect to charging network.
2. Multiple units shall have one unit designated as a master unit that is configured as a
3. gateway unit between the EV charging equipment and the charging network.
4. Individual units shall be capable of indicating station status and availability providing or connecting user to customer support and remote control.

2.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

B. Surge Withstand: 6 kV at 3000 A.

C. Integral GFCI.

D. Auto-GFCI fault retry.

E. Input Power: 40A AT 208VOLT 1 PHASE for each charger (2) for double charger.

F. EV charging levels.

1. Single vehicle, AC Level 2 at up to 7.2 kW per vehicle.
2. Dual vehicles, AC Level 2 at up to 7.2 kW per vehicle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1 and NECA 413.

B. Concrete Base Mounting: Follow manufactures recommendations for Concrete base mounting. Base to be a minimum of 4’ deep and 24” diameter.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. For each unit of EV charging equipment, perform the following tests and inspections:

a. Unit self-test. Retain one of two operational tests below.
b. Operation test with load bank.
c. Operation test with EV.
d. Network communications test.

D. EV charging equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262653

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Isolated-ground receptacles.
4. Switches and wall-box dimmers.
5. Floorboxes and multioutlet assemblies.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.6 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide ten (10) duplex receptacles and six (6) GFCI receptacles each with fifty feet 3/4-inch EMT-5#12 and four (4) elbows each. All installed at location directed by owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. All wiring devices shall be GRAY color, switched (controlled) receptacles shall be labeled and green color.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

2. Plug load receptacles shall be clearly labeled controlled and be green color.

a. Leviton 5362-SGW

3. Plugtail devices are acceptable

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. GRAY COLOR

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; CR 5253IG.
b. Leviton; 5362-IG.
c. Pass & Seymour; IG6300.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles: Where required by NEC

1. 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Provide in preschool and kindergarten rooms.
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TR8300.
b. Hubbell; HBL8300SG.
c. Leviton; 8300-SGG.
d. Pass & Seymour; 63H.

2.3 GFCI RECEPTACLES

A. All exterior receptacles, receptacles within ten feet of sinks and mop sinks shall be GFCI type whether indicated on drawings or not.

B. General Description: Straight blade. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Pass & Seymour; 2097 (No substitute).

2.4 RANGE RECEPTACLES: NEMA 14-50R

2.5 DRYER RECEPTACLES: NEMA 14-30R

2.6 SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.
3. Provide two keys with each switch.

2.7 OCCUPANCY SENSORS – See 260923

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices, stainless steel type 302.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
5. Legrand SS series

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum while in use with lockable cover.

1. Legrand #WIUCAST1 with correct device plate

2.9 FLOORBOXES – See 260533

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Install double duplex, four-plex, and multiple switch locations under common plate.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Selective Coordination: see section 260573 for selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.

6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products to match panelboard breakers.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Provide electronic trip where required for coordination.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 262913 – MOTOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:

1. Across-the-line, manual and magnetic controllers.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each enclosed controller.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Nameplate legends.
c. Short-circuit current rating of integrated unit.
d. Listed and labeled for series rating of overcurrent protective devices in combination controllers by an NRTL acceptable to authorities having jurisdiction.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed controllers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.6 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

C. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

D. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare Fuses: Furnish one spare for every five installed, but no fewer than one set of three of each type and rating.
2. Indicating Lights: Two of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
2. Danfoss Inc.; Danfoss Electronic Drives Div.
3. Eaton Corporation; Cutler-Hammer Products.
4. General Electrical Company; GE Industrial Systems.
5. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
6. Siemens/Furnas Controls.
7. Square D.

2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Manual Controller (Starter): NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."

1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.
2. Square D Class 2510

B. Magnetic Controller (Starter): NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
3. Hand off auto switch.
4. Red running and green stop pilot lights.
5. Control transformer.
6. Provide power factor correction capacitors for all motors over 15 HP to 95%.

C. Combination Magnetic Controller (Starter): Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL. Provide type RK1 time delay fuses
2. Magnetic controller per above.
3. Square D 8538, or equal.

2.3 ENCLOSURES

A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.4 ACCESSORIES – For AHU-4

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Elapsed Time Meters: Heavy duty with digital readout in hours.

C. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.

D. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.5 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers, Supports and Fasteners."

B. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."

3.4 IDENTIFICATION

A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers.

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic-control devices where applicable.

1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 CONNECTIONS

A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Ground equipment according to Division 26 Section "Grounding."

3.7 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, "Motor Control - Motor Starters." Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.8 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 262913

SECTION 263600 – AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 OPERATION

A. The Western State Campus operates as a hot bus with main transfer switches and generators located at the powerhouse. This is an NEC 702 system that powers the entire campus in an emergency situation.

B. Provide Automatic Transfer Switches (ATS) for this building as shown on the one line

1. ATS shall connect to the main control panel in the Powerhouse for remote control. ATS acts as a load shed device and drops approximately 300 KVA of load when the campus transfers to emergency power
2. There is no emergency circuit connect to the transfer switch to accomplish the load shed.
3. Provide contacts in control panel to initiate transfer when campus transfers to the generator system.
4. Provide class 2 wiring to the power house the tunnel system.

1.2 QUALIFICATIONS

A. Pre-approved transfer switches

1. Approved manufacturers listed here: Cummins, Westinghouse, Asco, and Caterpillar
2. For each project, transfer switches shall be of the same manufacturer.
3. Pre-approval subject to the manufacturer's ability to meet ALL of the specification requirements.

1.3 REFERENCES

A. Applicable codes, standards, and references

1. National Electrical Code - NEC
2. National Electrical Testing Association – NETA
3. UL 1008 – Automatic Transfer Switches
4. National Fire Protection Association – NFPA
5. State and local codes and ordinances

1.4 COORDINATION

A. Coordinate with Inspection, Calibration and Testing section

B. Coordinate Operations and Maintenance training times with the University.

1.5 SUBMITTALS

A. General

1. Submittals shall be in accordance with Conditions of the Contract and Division 01 Specification sections.
2. Submit detailed maintenance manuals and drawings, which include wiring diagrams, dimensions, front and side views and catalog information indicating complete electrical and mechanical characteristics.

1.6 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with Conditions of the Contract and Division 01 Specification Sections.

B. Operations and Maintenance Manuals shall include but not be limited to wiring diagrams, bus layout drawings, dimensions, front and side views and catalog information indicating complete electrical, mechanical characteristics, startup and testing reports.

1.7 MEETINGS

A. Attend meetings with the Owner and/or Owner's representative as required to resolve any installation or functional problems.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. General

1. Each transfer switch shall be enclosed in NEMA-1 general-purpose enclosure with front opening lockable doors. Access into enclosure shall be from the front.
2. All components of the assembly except those identified in these specifications by the manufacturer shall be a regularly manufactured product of the supplier.
3. Nameplates: Identify all equipment, operating handles, and devices on structure (exterior and interior) with engraved plastic laminated nameplates (red background with white lettering). Engraving shall identify equipment, emergency classification and supply sources to match nomenclature identification shown on equipment schematic and wiring diagrams.
4. Specifications

   a. Voltage rating: Transfer switches rated from 40 A through 1200 A are rated up to 600 VAC, 50 or 60 Hz.
   b. Arc interruption: Multiple leaf arc chutes cool and quench the arcs. Barriers prevent interphase flashover.
   c. Neutral bar: A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
   d. Auxiliary contacts Two contacts (one for each source) are provided for customer use. Wired to terminal block for easy access. Rated at 10A Continuous and 250 VAC maximum.
   e. Total transfer time (source-to-source): Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without delayed transition enabled.
   f. Manual operation handles: Transfer switches are equipped with permanently attached operating handles and quickbreak, quick-make

contact mechanisms suitable for manual operation under de-energized conditions.

g. Open transition/programmed – Controls the time required for the device to switch from source to source, so that the load-generated voltages decay to a safe level before connecting to an energized source. Recommended by NEMA MG-1 to prevent nuisance tripping breakers and load damage. Adjustable 0-10 seconds, default 0 seconds

h. Microprocessor control: Simple, easy-to-use control provides transfer switch

i. information and operator controls
   1) LED lamps for source availability and source connected indication, exercise mode, and test mode. LED status lamps also provided for control set-up and configuration.
   2) Pushbutton controls for initiating test, overriding time delays and setting exercise time.

j. Field-configurable for in-phase open or programmed open transition.

k. Integral exerciser clock

l. Control is prototype-tested to withstand voltage surges perEN60947-6-1.

m. Gold-flashed generator start contacts

n. Control functions
   1) Voltage sensing: All phases on the normal source and single phase on generator source. Normal Source Pickup: adjustable 90-95%,
   2) Dropout: adjustable 70-90% of nominal voltage; Generator Source Pickup: 90%, dropout: 75% of nominal voltage.
   3) Frequency sensing: Generator Source Pickup: 90% of nominal frequency; Dropout: 75% of nominal frequency.
   4) Exerciser clock: Switch is furnished with an integral engine exerciser configurable for operation on a 7, 14, 21, or 28-day cycle with a fixed exercise period duration of 20 minutes. A 12-hr exerciser time offset allows for the convenient setting of exercise time without the need to activate the timer at the exact time that you need to schedule the generator exercise for. Software selectable capability allows for the exercising of the generator with or without load.

o. Time-delay functions
   1) Engine start: Prevents nuisance genset starts due to momentary power system variation or loss. Adjustable: 0-10 seconds; default: 3 seconds
   2) Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-300 seconds, default 5 seconds.
   3) Retransfer emergency to normal: Allows the utility to stabilize before retransfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems. Adjustable 0-30 minutes, default 2 minutes.
   4) Genset stop: Maintains availability of the genset for immediate reconnection in the event that the normal source fails shortly

after transfer. Allows gradual genset cool down by running unloaded. Adjustable 0-30 minutes, default 10 minutes.

5) Delayed (programmed) transition: Controls the speed of operation of the transfer switch power contacts to allow load generated voltages from inductive devices to decay prior to connecting a live source. Adjustable 0-10 seconds, default 0 seconds.

6) Elevator signal: Provides a relay output contact for the elevator signal relay (load disconnect). The signal can also be configured to provide a post transfer delay of the same duration. Adjustable: 0-300 seconds (requires optional elevator signal relay for use). Not used

p. Programmable exerciser clock: Provides a fully-programmable 7-day clock to provide greater flexibility in scheduling exercise periods than standard integral exerciser. Time-of-day setting feature operates generator during periods of high utility rates.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Installation, mounting and electrical connections

1. In accordance with manufacturer's installation instructions and Seismic Zone 3 requirements
2. Install floor mounted transfer switches on housekeeping pads. Housekeeping pads may present difficulties to remove the automatic switching mechanism for maintenance for large and heavy switches, usually 1000A and larger. For large switches, do not use pads but provide other means to prevent dust and debris from entering switch enclosures.
3. Coordinate remote monitor and control signal connections with the University.

B. Training

1. Provide operation and maintenance training by a factory-trained instructor for two 2-hour sessions of on-site training for a total of 6 maintenance personnel.
2. Include troubleshooting, repair and maintenance manuals for each participant.

C. Testing

1. Provide factory field startup and testing services to assist the ETC (Electrical Testing Contractor) per the Inspections, Calibration and Testing Section.

END OF SECTION 263600

SECTION 265100 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Fixture requirements:

1. DLC – all fixtures shall have DLC, Energy Star, or equivalent label

D. Retain "Samples" Paragraph for custom luminaires and single-stage samples. Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

E. Samples: For each luminaire and for each color and texture with standard factory-applied finish where requested.

F. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.

G. Include Samples of luminaires and accessories involving color and finish selection.

H. Samples for Verification: For each type of luminaire.

I. Include Samples of luminaires and accessories to verify finish selection.

J. Product Schedule: For luminaires and lamps. See Drawings for schedule

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

G. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 SPARE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. LED Drivers/Power Supplies

a. Provide (4) LED Driver/Power Supplies for RL-1 and PL-1
b. Provide (1) LED Driver/Power Supplies for each other type

2. LED Driver/Power Supplies: Provide 1 for each fixture type

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 COLOR TEMPERATURE

A. All fixtures are 4100K unless noted otherwise

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 TEST REPORTS

A. LED Luminaire IES LM-79: Test Report Submit test report on manufacturer's standard production model luminaire. Include all applicable and required data as outlined under "14.0 Test Report"

B. LED Light Source IES LM-80 Test Report: Submit report on manufacturer's standard production LED light source (package, array, or module). Include all applicable and required data as outlined under

C. LED Light Source IES TM21 Test Report: Submit test report on manufacturer's standard production LED light source (package, array or module). Include all applicable and required data, as well as required interpolation information as outlined in IES TM-21.

1.11 LUMINAIRE USEFUL LIFE CERTIFICATE

A. Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life must be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions must be taken into consideration

1.12 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Verify available warranties and warranty periods.

C. Warranty Period: Minimum Five year(s) from date of Substantial Completion unless manufacturers standard warranty is longer

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61

F. CRI of minimum 80 unless noted. CCT of 4000 K unless noted

G. Minimum Rated lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: Per Drawings

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

K. Housings:

1. Extruded-aluminum housing and heat sink.
2. Custom color per architect from provided paint chip

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes: Per drawings

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.4 LED POWER SUPPLIES/DRIVERS

A. UL 8750 LED power supplies (drivers) must be electronic, UL Class 1 , constant-current type and comply with the following requirements:

1. Output power (watts) and ouput current (mA) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.
2. Power Factor (PF) greater than or equal to .90.
3. Total Harmonic Distortion (THD) of less than 20%.
4. Class A sound rating.
5. Operable at input voltage of 120-277 volts at 60 hertz.
6. Minimum 5 year manufacturer's warranty.
7. RoHS compliant.
8. Integral thermal protection that reduces output power if case temperature exceeds 185 degrees F 85 degrees C

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or Attached to a minimum 20 gauge backing plate attached to wall structural members
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports connected to structur above ceiling
2. Ceiling mount with pendant mount with minimum 5/32-inch- (4-mm-)]diameter aircraft cable supports.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Retain first subparagraph below to require ceiling grid to be connected to building structure at four corners of luminaire opening.
3. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
4. Retain subparagraph below if ceiling grid is not connected to building structure at four corners of the luminaire opening.
5. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265100

SECTION 265600 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted motion sensors.
3. Poles and accessories.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

a. indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. LED Panels: 2 of each type
2. LED Drivers: 2 of each type
3. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See lighting fixture schedule

B. LED Modules: See fixture schedule. Minimum 5 year warranty, L70 rated for 75,000 hours

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

J. Luminaire Finish: Allow for custom color on any fixtures

K. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

L. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2.3 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all poles

E. Concrete Pole Foundations: Precast Utility Vault#24R-8-LB. See fixture schedule for exceptions

2.4 POLE ACCESSORIES

A. Where shown on drawings accommodate security camera mount. Provide for (2)Axis P3346/67-VE camera and mount and provide additional strength to support weight

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and

B. Bonding for Electrical Systems."

1. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

END OF SECTION 265600

dj/July 17, 2017

SECTION 271500 – DATA VOICE CABLING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all materials and labor for the installation of a communications (telephone and data) (voice and data) cabling and termination system. This section includes Communications cabling, termination, and administration equipment and installation requirements for the specified System

B. Include all materials for the installation of a video surveillance cable plant and termination system including data cable and fiber cable.

C. Contractor must be a current Leviton/Berktek Certified Installer or alternate approved equal

1.2 REFERENCES

A. General:

1. National Electrical Code (NEC)
2. National Electrical Safety Code (NESC)
3. Washington Industrial Safety and Health Act (WISHA)
4. Occupational Safety and Health Act (OSHA)
5. International Building Code (IBC)

B. Communications:

1. ANSI/TIA/EIA - 455: Fiber Optic Test Standards
2. ANSI/TIA/EIA - 526: Optical Fiber Systems Test Procedures
3. ANSI/TIA/EIA - 568-B: Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
5. ANSI/TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
6. ANSI/TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
7. ANSI/TIA/EIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems
8. ANSI/TIA/EIA -TSB75: Additional Horizontal Cabling Practices for Open Offices
9. NECA/FOA 301: Standard for Installing and Testing Fiber Optic Cables
10. NECA/BICSI 568: Standard for Installing Commercial Building Telecommunications Systems
11. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard
12. ISO/IEC IS 11801: Generic Cabling for Customer Premises
13. BICSI: ITSIM Information Transport Systems Installation Manual

14. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)

1.3 DEFINITIONS

A. Voice, Telephone, and Phone are used throughout this section to refer to the telephone.

1.4 SYSTEM DESCRIPTION

A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA, NECA/NEIS and lSO/IEC compliant communications Structured Cabling System as hereinafter specified and/or shown on the Contract Documents. The system is intended to be capable of integrating voice and data signals onto a common media, and shall be tested for and be capable of 1 Gigabit Ethernet operation for copper cable as specified in IEEE 802.3 and 10 Gigabit Ethernet operation for fiber optic cable.

B. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant cabling system.

1.5 SUBMITTAL INFORMATION

A. The Contractor shall apply Contractor's stamp, sign, or initial certifying that review, verification of required Products, and coordination of information is in accordance with the requirements of the work and Contract Documents.

B. Any deviations from the Contract Documents or specified product data shall be clearly noted, and must be reviewed by owner and approved by the Engineer prior to start of construction.

C. If the deviation is not reviewed by owner and approved by the Engineer it remains the Contractor's responsibility to provide what is required in the Contract Documents".

D. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Combine product submittals for all products and submit together as a single submittal.

1. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

E. Quality Control Submittals: Provide submittal information for review as follows:

1. In accordance with the QUALITY ASSURANCE requirements below, submit the contractor-qualifications documentation

2. Documentation indicating that the Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below.
3. Documentation demonstrating that the Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The document shall declare that the RCDD is a direct full time employee of the Contractor also that the Contractor will continue to employ a minimum of one RCDD throughout the duration of the project.
4. List of references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor under the Contractor's current business name within the past three years. Detail the following for each project:

    a. Project name and location
    b. Construction cost
    c. A brief description of the project, the components involved, and the SCS manufacturer used on the project.
    d. Number of station drops
    e. Customer contact names, phone numbers, and addresses

5. Submit a cable routing and grouping plan submittal as follows:
6. Where the cable routing and grouping is to be provided as shown on the Contract Documents, do not provide a cable routing and grouping plan. Submit written documentation stating that the cable routing and grouping will be provided as shown on the Contract Documents, that the Contractor has reviewed the routing and grouping on the Contract Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts with other building utility infrastructure, and that the routing and grouping meets applicable codes, regulations and standards.
7. Where changes in cable routing and grouping are proposed, submit complete floor plan(s) and/or detail drawing(s) showing the proposed routing, raceway sizes and locations, and cabling in a manner equal to that of the Contract Documents. Ensure that any cabling changes are coordinated with accommodating changes to the raceway routing and grouping. Specifically note each location where the proposed routing and grouping is different from the Contract Documents. Submit written documentation detailing the reason for each change request. Each change request must be approved in writing by the Engineer after review by the owner prior to proceeding with the change.
8. Submit patch panel and wire management elevations as follows:
9. Where patch panels and wire management are to be provided as shown on the Contract Documents, do not submit elevations. Submit written documentation stating that the patch panel and wire management will be provided as shown on the Contract Documents, that the Contractor has reviewed the elevations on the Contract Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts between trades, and that the elevations meet applicable codes, regulations and standards.
10. Where changes to patch panels and wire management are proposed, submit patch panel and wire management elevations along with written documentation detailing the reason for the change. The change request must be approved in writing by the Engineer after review by the owner prior to proceeding with the change.

11. Submit a list of proposed test equipment for use in verifying the installation of the SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING.
12. Submit for each testing device:

    a. Manufacturer and product number
    b. Documentation from the manufacturer showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer's recommended calibration period, encompassing the period of time when the testing device will be used on this project.
    c. Documentation from the manufacturer showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.
    d. Testing equipment must be approved by engineer after review by the owner.

F. Closeout Submittals: Provide submittal information for review as follows:

1. A communications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for this project. O&M information submitted under other related communications sections (e.g. Raceway and Boxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications.
2. 2 copies of either a CDR or DVD of the Fluke test data sorted in .flw format for all copper and fiber cables compatible with latest version of LinkWare Single copy of notebook bound, printed, color, double sided and sequentially organized of all copper and fiber test results
3. 2 copies of either a CDR or DVD of the project's completed as-built drawings denoting the installed and individually labeled data drops at their locations in PDF format from digital CAD versions of the Electrical Data/Comm sets (See example below)
4. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description. Provide bound copies of the O&M Manual for Communications per Division 1.
5. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of changes to Contract Documents such as drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.
6. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.
7. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time.

8. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).
9. Show identifiers for major infrastructure components on Record Drawings.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the system and be certified by the Manufacturers to provide the Manufacturers' Warranties (see PART 1 - WARRANTY).
2. Contractor's employees directly involved with the supervision, installation, testing, and certification of the SCS shall be trained and certified by the selected SCS' manufacturers. Training and certifications by employee type are required as shown below:
3. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing.
4. Test Technicians: All (100%) shall be trained/certified for installation and testing.
5. Installation Technicians: Prior to bidding, half (50%) shall be trained/certified for installation. Upon award of the project, the remaining untrained installation technicians shall be trained and certified by the manufacturer at no cost to the Owner.
6. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the SCS (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer trained and certified. Otherwise, personnel not manufacturer-trained and certified shall not be allowed on the job site.
7. Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:
8. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.
9. Firestopping Technician: All (100%) shall be trained/certified for installation.
10. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.
11. Contractor shall have successfully completed no less than five similar projects (in terms of size and construction cost) under the Contractor's current business name within the past three years.

1.7 SCHEDULE

A. Provide coordination with the cabling manufacturers to ensure that manufacturers' inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any manufacturer-required modifications and have manufacturer re-inspect and certify the system prior to the scheduled use of the system by the Owner. Owner will attend manufacturer's inspections. Provide 1 week written notice prior to any inspections.

B. The Contractor is solely responsible for all costs associated with scheduling the manufacturer inspection, the inspection itself and any manufacturer-required re-inspections, and for any modifications to the installation as required by the manufacturers.

C. See architectural plans for phasing of project. All fiber optic and copper communications feeds from campus systems are to be installed and tested prior to occupancy of any phase. All fiber optic and copper feeds from MDF to IDF in occupied side of building shall be installed and tested prior to occupancy of any phase of building.

1.8 WARRANTY

A. Manufacturer Warranties:

1. Provide Leviton Limited Lifteim Performance Warranty for Category 6 and Fiber Optic Cable. The System Manufacturer warranties shall warrant:
2. That the products will be free from manufacturing defects in materials and workmanship.
3. All copper products shall meet EIA/TIA & ISO Component Rated 3rd Party Verified Category 6 requirements.
4. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
5. That the installation shall exceed the specification of ANSI/TIA/EIA 568-B and exceed ISO/IEC 11801 standards.
6. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-B and ISO/IEC 11801 component and link/channel specifications for cabling.
7. Provide a copy of the warranty registration document to the Owner at the time of submittal to Leviton.
8. Provide materials and labor attributable to the fulfillment of this warranty at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specifically stated as “Or equal”, equivalent items are not acceptable. Provide items as specified.

B. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths of conduit and/or pathway to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.

C. Components shall be manufactured by the manufacturers listed below. Components shall not be intermixed between different manufacturers unless the manufacturer has listed (in writing) another manufacturer’s component as an “Approved Alternative Product” and will warrant the “Approved Alternative Product” as part of the Manufacturer Warranty (see PART 1.9 - WARRANTY).

1. Leviton/Berktek connectivity
2. Chatsworth Racks and cable management

D. All copper-related components shall be part of the copper product line and all fiber optic-related components shall be part of the fiber optic product line – components shall not be intermixed between manufacturers' product lines. The SCS product lines shall be engineered "end-to-end" – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

E. Racks, rack cable distribution hardware, ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification or in the Contract Documents. Do not intermix equipment and components between different manufacturers.

F. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operational, tested, certified and warranted system.

2.2 DATA (D) AND TELEPHONE (T) CABLE

A. Category 6: Shall exceed Category 6 transmission requirements as specified in ANSI/TIA/EIA 568-B and ISO/IEC 11801: Berktek Lanmark 1000 (10032093) enhanced Category 6 plenum. Cable shall be blue. Cable shall not be run underground

B. Underground Cable shall be used only where specifically approved by engineer and shall exceed Category 6 transmission requirements. BerktekLanmark 6 OSP(10139885). Cable shall not be run in Building.

2.3 FIBER OPTIC CABLE

A. Indoor, single mode OS2, 12 strand. Berktek#PDP012AB0707

B. Underground and outdoor from building to Building 18, single mode OS2 24 strand. Berktek# PDRZ012AB0707-I/O

C. All fiber optic cables must be in innerduct.

2.4 MAIN TELEPHONE CABLE AND TERMINATION

A. Provide 200 pair PE-39 gel filled telephone cable to building 18. Superior Essex 04-108-04

B. Protector: Circa #1880ENA1/NSC-200 or equal on each end

C. Termination: Systimax 569445 with 558402-1 inserts for each pair

2.5 OUTLETS

A. Outlets shall be EIA/TIA 568 Category 6, modular with number of RJ45 jacks indicated by Symbol on front. Provide blanks in unused sections. Gray Color with stainless plates.

Label all jacks individually. Plate shall be labeled with outlet number(s) shown on drawings. Inserts shall be 61110-R*6. Blanks shall be Leviton All 6 openings shall be filled.

1. WAP and Video surveillance jacks shall be terminated with biscuit jack when on a ceiling or accessible wall and a minimum 10' loop. Terminate on a plate when on a non-accessible wall

B. Plate shall be Levition stainless steel (Part No.) 43080-1L6 plate with ID windown and cutout section for 6 mounting spaces for 61110 connectors. Plate shall be labeled with outlet number(s) shown on drawings as detailed below. Provide blanks in all unused locations

1. Label Shall be MDF/IDF –Rack # - Patch Panel # - Outlet #. Field room number shall be under outlet.

2.6 DATA PATCH PANELS

A. EIA/TIA 568, Category 6, RJ45 insert jacks on front. Provide patch panels in MDF and all IDFs. Levition # 49255-H48 , fully loaded with Category 6 connectors (61110-R*6).

1. Label Shall be Outlet #. Field room number shall be under outlet.

2.7 FIBER OPTIC PATCH PANELS

A. Provide rack mounted interconnection unit with space for fibers. Provide panel coupling. All terminations in patch panels shall be LC type. Provide space for all ies on separate shelves. Levition DP04U Series enclosure, mounting coupling bracket, and LC connectors for each fiber on 6 LC plate. Provide rack mount kit, grounding kit, key lock kit, and universal cable mount kit.

2.8 DATA AND TELEPHONE PATCH CORDS

A. Data and Telephone Patch Cables: Pre-manufactured (factory-terminated), stranded unshielded twisted pair (UTP), Leviton #6D560-xx with 8-pin modular plugs (RJ45), Category 6. Leviton. Provide 200 data patch cords, Lengths shall be 25%, 9 foot, 50%, 6 foot, and 25% 3 foot. Color shall be blue. Provide 60 telephone patch cords. Length shall be 30% 9 foot, 40% 6 foot, and 30% 3 foot.

2.9 Fiber Optic Patch Cord:

A. Single Mode: LC on each end. Provide (6) 3 feet, (12) 6 feet, and (6) 9 feet cords. Leviton UPDLC

2.10 PATHWAYS AND CABLE SUPPORTS

A. Installation and materials for the raceway and boxes for the SCS shall be as specified under 260534 except where noted below.

B. All cabling pathways are to be installed within 4 feet of the ceiling grid. No cabling pathway is to be located above 4 feet above ceiling grid.

C. Cable Supports: ~~All cable to be installed in J-Hooks, Raceway, or Cable Tray. No other means acceptable except 4" J-Hooks that are connected to structure via a rigid stem. All outlets shall have conduit stubbed from outlet to cable tray and bonded to the cable tray.~~ *All cable to be installed in J-Hooks, Raceway, or Cable Tray. No other means acceptable except 4" J-Hooks that are connected to structure via a rigid stem. All outlets shall have conduit stubbed from outlet to above accessible ceiling. Cable to be in conduit where no ceiling exist. (Addendum Three)*

D. Cable Tray:

1. Ladder rack, Chatsworth – Basket type with 6" side rails and 12" wide unless noted on drawings with all accessories required.
2. Include the following and all additional accessories for a complete system as shown on drawings
3. Basket Tray: CPI #34831-712
4. Radius Drop: CPI #34741-701
5. Bend Radius: CPI #34742-706
6. Splice Kit and Bars: CPI #34738-701
7. Ground Kit: CPI #34838-001
8. Support: Wall Mount: CPI # 34733-712 (Minimum every 4 feet)
9. Support – Center Ceiling Mount: CPI #34729-712
10. Ground Washer: CPI # 34746-701
11. Wire Cutter: CPI # 34839-001

E. Innerduct: 1 ¼" Outside Diameter, bright orange in color. Plenum rated.

F. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

G. Velcro Wraps: Hubbell HVFBK5875

2.11 FIRESTOPPING

A. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:

1. Specified Tech. Inc. (or approved equal).

2.12 EQUIPMENT RACKS/ENCLOSURES

A. Unless otherwise indicated, equipment racks/enclosures and incidental equipment color shall be black or clear aluminum.

B. Unless otherwise indicated, equipment rack and incidental materials and equipment shall be provided by the selected Rack/Distribution Equipment manufacturer. Do not intermix products from different manufacturers except as specifically shown.

C. Free Standing Equipment Racks: EIA-standard 7-foot high x 19-inch wide racks with universal alternating-hole pattern, complete with top angles, self-supporting bases, and mounting holes on both sides of the rails.

1. Rack, 4 post: CPI #15053-X03
2. Vertical Cable Management CPI # 13902-703 Double Sided 6" Wide Vertical Cable Manager
3. Horizontal Cable Management: CPI # 139530-702
4. Power Strips (2 per rack - to be mounted at lowest section): *CPI ##12820-701 (Addendum Three)*
5. Double-sided shelves (provide 4 total for building): CPI #11164-719
6. Grounding kit and #6 AWG insulated copper conductor grounded to the nearest TGB.
7. Horizontal Rack Busbar: CPI #10610-019
8. #6 Ground Wire: CPI # 40159-001

D. Cable Runway (Not Cable Tray): CPI #11911-712 for mounting racks back to wall. Provide all waterfalls, drops, connectors for a complete system per the drawings.

E. Incidental materials required for proper construction, mounting and securing.

2.13 LABELING AND ADMINISTRATION

A. Labels:

1. As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.
2. For Station Cable:

a. Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

3. For Backbone Cable:

a. Panduit Marker Tie (or approved equal) in the MDF and IDF within 12" of termination point.

B. Hand-carried label maker:

1. Brady: ID Pro Plus (or approved equal).

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

F. Remove surplus material and debris from the job site and dispose of legally.

3.2 MDF/IDF CREATION

A. Room Layout

1. Details of the MDF/IDF layout must be reviewed by Owner prior to construction, including rack locations, PBX location, ladder locations, etc.
2. Lighting in MDF/IDF to be 12 inches away from any cable bundles to minimize EMI.
3. Keep MDF and IDFs accessible and clean to facilitate other services that may need access during construction phase.
4. Any cable(s) entering MDF/IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).

3.3 RACEWAY

A. Cable run layouts indicated on the drawings are generally diagrammatic. Exact routing of conduit and wiring shall be governed by the location of obstructions and building structural conditions. Cable runs shall strictly adhere to BICSI standards for EMI distances.

B. All cable shall be routed to prevent interference with any existing systems such as access boxes, ventilation mixing boxes, access hatches to air filters, switch panels, fire alarm equipment, clock systems, lighting fixtures, etc. All pathways for copper cable shall be a minimum of 12" from all fluorescent lighting ballasts, fire alarm, paging and any other low voltage cables not in EMT or flex conduit. The routing must not interfere with any other service or system, operation or maintenance. Raceway shall not be placed in close contact with other devices, electrical or otherwise, that will interfere with it's proper operation as a transmitter of data signal as per TIA/EIA 569-A. The contractor will be responsible for rerouting any raceway that is not acceptable to the Engineer at contractor's expense.

C. J-Hooks SHALL be 4” minimum and supported directly to structure Erico.

D. Data and phone cables shall not share sleeves with any other cables.

E. All cables passing into and out of all IDFs and MDFs must be in sleeves with bushings and have proper fill ratios. Provide (1) 4" spare sleeve with capped.

F. Backboards: Proved backboards as shown on Contract Documents. Backboards shall be capable of supporting attached equipment, and painted with a minimum of two coats (over primer) of fire retardant, non-conductive paint, and one coat of white colored semi gloss top coat paint. Mount A-C plywood backboards with the "A" side exposed.

G. Sleeves: Provide sleeves where required for cable pass-thru through building structures and/or fire rated barriers. Provide roto-hammering or core drilling where required for sleeve installation. Seal (and if a fire rated barrier, firestop) between sleeve and building structure and/or barrier. Size sleeves:

1. As noted in the Contract Documents.
2. Where not noted, size sleeves a minimum of 2 inches in diameter or by the type and quantity of cable to be routed through the sleeve per ANSI/TIA/EIA 569 cable capacity standards plus an additional 100% for future expansion - whichever is greater.

H. D-Rings: Provide D-Rings as necessary for vertical management only for exposed cables on backboards in telecommunications rooms.

I. Innerduct: Provide bright orange innerduct as pathway for backbone fiber optic cables (backbone only – not station cables), from backbone fiber patch panels to conduit or plenum entrances, and as shown in the Contract Documents.

J. Pull Strings: Provide a pull string in conduits that are to remain vacant.

3.4 FIRESTOPPING

A. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.

B. Maintain fire rating of penetrated fire barriers. Fire stop and seal penetrations made during construction.

1. Provide firestopping material for membrane penetrations of fire-rated barriers.
2. Install firestops in strict accordance with manufacturer’s detailed installation procedures.
3. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of fire stop material in a manner acceptable to the local fire and building authorities.
4. Firestopping material used to seal open penetrations through which cable passes shall be re-usable/re-enterable.

3.5 EQUIPMENT RACKS/ENCLOSURES

A. Provide EIA racks/cabinets and all associated hardware according to locations, elevations, and plan views as shown in the Contract Documents.

B. For Floor Mount Racks/Cabinets:

1. Using cable runway, horizontally affix the top of a given rack/cabinet to the wall as shown on the Contract Documents. Bolt horizontal ladder rack to rack/cabinet and to walls. Bolt rack/cabinet to floor.
2. Any cable(s) entering MDF/IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).

3.6 GROUNDING AND BONDING

A. Grounding and bonding work shall comply with the International Building Code, International Fire Code, WAC, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Provide a minimum of one wall-mountable telecommunications ground bus bar per telecommunications room and as shown on the Contract Documents.
2. Grounding conductor shall be installed to bond all non-current carrying metal telecommunications equipment and materials to the nearest TMGB or TGB (as provided under Division 16 Section — “Grounding for Communications Circuits and Raceway”).
3. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.
4. Provide ladder rack grounding kits to bond each section of ladder rack and bond ladder rack to racks/cabinets where ladder racks are connected.
5. Provide a grounding point for telecommunication systems and equipment with a copper busbar located in each IDF (Intermediate Distribution Frame) room. This busbar is directly bonded to the TMGB (Telecommunications Main Grounding Busbar) by means of a TBB (Telecommunications Bonding Backbone) and then finally to the electrical service ground or structural steel, all according to ANSI - J-STD-607-A.

3.7 PATCH PANELS

A. Provide patch panels and horizontal wire management according to locations, elevations, and plan views as shown on the Contract Documents.

1. Fiber: Size and install rack-mountable patch panels as shown on the Contract Documents. Use fiber patch panels to terminate multimode fiber backbone cables.
2. Copper: Size and install rack-mountable patch panels as shown on the Contract Documents. Use copper patch panel to terminate horizontal cable on rack(s). All for spacing between patch panels for horizontal cable management.

3.8 CONNECTORS

A. Copper Connectors (modular jacks):

1. For Horizontal Distribution:
2. Provide connectors and install using T568A wiring pattern.
3. Mount connectors at 90-degrees (i.e. straight, not angled)
4. Must re-apply all dust covers to all jacks after punching down the cable.
5. All terminations must adhere to BICSI standards, e.g. CAT6A requires maximum of 1/8" insulation stripped back. All cable punched down on CAT6A jacks must approach the jack normal to the plane of the punch down terminals.

3.9 STATIONS

A. Faceplates: Provide faceplates for stations in the locations and gang counts shown on the Contract Documents. Faceplates shall completely conceal outlet boxes, reducer plates, etc. Faceplates shall provide a snug and sure fit for connectors – loose connectors are not acceptable and be mounted neatly and parallel to adjacent building lines.

1. Flush-mount connectors on faceplates.

B. Faceplate Mounting Brackets: Provide faceplate mounting brackets as required and as shown for flush mounted communications outlets. Provide blanks in all unused ports.

3.10 CABLE

A. General (applicable to all cable types): Provide plenum (CMP, OFNP) rated cable. Cabling shall bear plenum markings for the environment in which it is installed.

1. For Horizontal Distribution: Provide station cable in types, sizes, and quantities as shown on drawings. Install cable between the station and it's associated telecommunications room. Provide one cable per each connector at each station.
2. For Intrabuilding Backbone Distribution: Provide intrabuilding backbone cable in types, sizes, and quantities as shown on the Contract Documents. Install intrabuilding backbone cables between telecommunications rooms within the same building. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.
3. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI ITSIM (previously TCIM) practices.
4. Adhere to the bending radius and pull strength requirements as detailed in the ANSI/TIA/EIA standards and the manufacturer’s installation recommendations during cable handling and installation.
5. Pull all cables simultaneously where more than one cable is being installed in the same raceway.
6. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).
7. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cabling installation.

8. Install cable in a continuous (non-spliced) manner unless otherwise indicated.
9. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.
10. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc.) is not acceptable. Install velcro-wraps in conformance with the SCS manufacturer's installation recommendations. Do not over-tighten velcro wraps or cause cross-sectional deformation of cabling.
11. Cable at the backboards:
12. Lay and dress cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.
13. Route cable as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
14. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Velcro-wrap similarly routed and similar cables together and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.
15. Cable in the telecommunications rooms:
16. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with velcro straps.
17. Any cable(s) entering MDF/IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).
18. Cable terminating on patch panels located on racks:
19. Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical ladder rack to patch panel.

B. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

1. For horizontal distribution: Provide station cable in the locations shown on the Contract Documents. Provide service loops with a minimum length of 36 inches above each drop location at the entrance of each stubbed conduit above the ceiling grid and for classroom drop conduits running entirely to primary hallway cable trays, then lay cable loosely in tray to act as future slack.
2. For intrabuilding backbone distribution: Install intrabuilding backbone cable in the locations shown on the Contract Documents. Provide a service loop long enough in the TR's to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum length of 10 feet at each end.
3. Use unshielded, non-plenum multi-pair copper cable for connecting the back side of termination blocks to entrance protectors, telephone systems, and voice grade active electronics.

4. For shielded cable, bond both ends of the metallic shield (or metallic strength) member to the nearest TGB (as furnished under Division 16 Section — "Grounding and Bonding").

C. Fiber Cable: Terminate all fiber strands within a fiber cable. The installation of "dark fiber" is not acceptable.

1. For Intrabuilding Backbone Distribution:
2. Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.

   a. Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.
   b. Demonstrate that the test results are in agreement with the factory test results as shipped with the reel.

3. For shielded cable, bond both ends of the metallic shield (or metallic strength) member to the nearest TGB (as furnished under Division 16 Section — "Grounding").
4. Provide a service loop long enough in the MDF/IDF to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 10 feet at each end.
5. The service slack stored inside the fiber patch panel cabinets shall be a minimum of 3 m (10 ft).

3.11 CABLE ASSEMBLIES (PATCH CORDS) AND CROSS-CONNECTS

A. Furnish copper patch cables for modular copper cross-connects per 2.8.

3.12 LABELING AND ADMINISTRATION

A. General: Labeling and administration shall comply with ANSI/TIA/EIA 606 and standard industry practices.

B. Must use Times New Roman serif font at 18 point for faceplate labeling and fit to size legibly for patch panel labels so as to distinguish between "I" and "1".

C. Color Coding: Apply industry standard color coding to cable termination fields. Always apply the same color at both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the backboard behind the termination equipment, may be the color of a cover on the termination equipment, or may be the actual color of the insert label on the termination equipment. Use the following color code:

1. Orange: Identification of the telecommunication service (telephone company) demarcation point.
2. Green: Identification of network connections on the customer side of the demarcation point.

3. White: Identification of first-level backbone in the building containing the main cross-connect, or may be used to identify the second-level backbone in buildings not containing the main cross-connect.
4. Gray: Identification of the second-level backbone in the building containing the main cross-connect.
5. Blue: Identification of the horizontal distribution (station) cables. A blue color coding is only required at the telecommunications room end of the cable, not at the station end of the cable.

D. Racks: Label racks as shown on the Contract Documents. Affix label centered across top cross-member of rack.

E. Grounding/Bonding Conductors: Label bonding conductors; "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

F. Cables:

1. Label Location: Label at each end of the cable within 12" of the termination.
2. Station Cables: Label station cables with the same label as the station connector (see STATION CONNECTORS (PORTS) below) that terminates the cable at the station location. Handwritten (neat and legible) labels using a permanent black marker such as a Sharpie are allowed.
3. Copper Backbone Cables: Label intrabuilding copper backbone cables in the form "C (MDF to IDF), ###-PR, CAT##, ###-FT " where "C" stands for media type ("C" for "administrative copper" media), "(MDF to IDF)" is the origination and destination telecommunications rooms between which the cable routes, "###-PR" is the pair count, "CAT##" is the cable type (i.e. CAT3 or CAT5E), and ###-FT is the cut length.
4. Example: If a copper backbone cable running between MDF1 and IDF6 were a 150-FT long, 100-PR, CAT3 cable, then the label for the cable would read "C (MDF1 to IDF6), 100-PR, CAT3, 150-FT"
5. Fiber Backbone Cables: Label intrabuilding fiber backbone cables in the form "F (MDF to IDF), ###-ST, type, ###-FT " where "F" stands fiber, "(MDF to IDF)" is the origination and destination telecommunications rooms between which the cable routes, "###-ST" is the strand count, "type" is the fiber type (i.e. SM, 50MM, etc), and ###-FT is the cut length.
6. Example: If a 12-strand, 50 micron fiber backbone cable running between telecommunications rooms "MDF1" and "IDF6" were 75-FT long, then the label for the cable would read "F (MDF1 to IDF6), 12-ST, 50MM, 75-FT"
7. Provide labels at each end of each cable within 12" of telecommunications room entrance and again within 24" of termination point.

G. Termination Blocks:

1. General:
2. Label termination block ports/pairs sequentially beginning on the first row of each termination block column. Begin with "001" for the first port/pair.
3. Label termination strip pairs sequentially (left to right).

H. Patch Panels:

1. For Horizontal Distribution:
2. General: Label patch panels as shown on the Contract Documents.
3. Must use TIA/EIA 598-A color code for all fiber strand termination and all terminated fiber needs to be in the recommended order and be consistent at both ends.
4. Both ends of fiber termination must be labeled to identify where the other end is coming from. A fiber legend displayed inside the termination box is acceptable.
5. Label fiber termination box with destination IDF or MDF.

I. Station Connectors (Ports): (See 2.5.B)

J. Conduits: Label each conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room identifier, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

3.13 TESTING

A. Provide test records on a form approved by the Owner and Engineer/Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification as discussed under LABELING AND ADMINISTRATION above. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Engineer/Designer for review and acceptance within two weeks of Substantial Completion.

1. Print test records for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic form (on CDROM) to be reviewed by the Owner and approved by the Engineer. Handwritten test results will not be accepted nor any spreadsheet tabulated data forms.
2. 2 copies of either a CDR or DVD of the Fluke test data sorted in .flw format for all copper and fiber cables compatible with latest version of LinkWare Single copy of notebook bound, printed, color, double sided and sequentially organized of all copper and fiber test results
3. 2 copies of either a CDR or DVD of the project's completed as-built drawings denoting the installed and individually labeled data drops at their locations in PDF format from digital CAD versions of the Electrical Data/Comm sets (See example below)

B. Test the SCS after installation for compliance to all applicable standards as follows:

1. Copper:
2. For Horizontal Distribution, including Backbone Distribution: Test all pairs of each copper station cable, for conformance to ANSI/TIA/EIA 568-B Category 6in the Base Bid and Category 6A, and ANSI/TIA/EIA 568-B standards. To the extent possible, perform tests with building electrical systems fully powered on (i.e. Lights, HVAC, etc.).

a. Test each end-to-end link (the entire channel from the connector at the station to the connector or termination in the telecommunications room) utilizing sweep tests, for alien cross talk, continuity, shorts, polarity, near-end cross talk (NEXT), far-end cross talk (FEXT), attenuation, installed length, transposition (wire map), mutual capacitance, characteristic impedance, resistance, ACR, and presence of AC voltage. Use the Power Sum method to test NEXT and FEXT.
b. Use a TIA/EIA Level III testing instrument from either Fluke or Agilent Wirescope, or owner pre-approved for all copper testing. The test instrument needs to be re-calibrated within the manufacturer's recommended calibration period, with the most current software revision based upon the most current ANSI/TIA/EIA testing guidelines and be capable of storing and printing test records for each cable within the system.
c. In addition to the above, perform tests both recommended and mandated by Leviton for Permanent Link. Tests shall confirm/guarantee compliance to Leviton Ethernet Category 6A 10GBase-T (10000 Mb/s IEEE 802.3ab) and 10000B-TX (1000 Mb/s ANSI/TIA/EIA-854)

3. For Intrabuilding Phone Backbone Distribution: Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 6 standards.

a. Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.
b. Test entire channel, from termination block to termination block.

4. Fiber: Test fiber optic cable on the reel upon delivery to the job site prior to installation, and again after installation.
5. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:

a. For Backbone Distribution:
1) Max Loss = [(allowable loss/km) * (km of fiber)] + [(.3db) * (# of connectors)]
2) A mated connector to connector interface is defined as a single connector for the purposes of the above formula.
3) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).

6. Test all strands using a bi-directional end-to-end optical transmission loss test instrument (such as an OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to-end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B to eliminate any possible fiber core misalignments at connectors or splice points.

a. Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.
b. Provide test measurements as follows:
   1) Each connector = less than .5 db
   2) Each splice = less than .2 db
   3) Length loss less than .1 db per 100 feet
   4) Total loss not to exceed 3.9 db for 1000Base-SX (Gigabit Ethernet)

7. Test results shall conform to:

   a. The criteria specified in ANSI/TIA/EIA-568B
   b. The Contractor's calculated loss budget above
   c. The criteria specified in IEEE 802.3 (10000Base-X 10 Gigabit Ethernet)
      1) In addition to the above, perform tests both recommended and mandated by Berktek/Leviton. Tests shall confirm/guarantee compliance to performance standards and also IEEE 802.3

C. Identify cables and equipment that do not pass to the Owner and Engineer/Designer. No marginal or star passes allowed. Marginal Pass must be enabled on all test instruments. All FAILS need to be corrected and no re-certify status of test data accepted. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials at no additional expense to the Owner. Provide new test results to the Owner and Engineer/Designer in the same manner as above.

1. In addition to the above, if it is determined that the cable is at fault, remove the damaged cable and replace it with a new cable. Cable "repairs" are not acceptable. The procedure for removing the cable shall be as follows:
2. Prior to removal of damaged cable and installation of new cable:

   a. Inform the Owner and Engineer/Designer of the schedule for the removal and installation.
   b. Test the new cable on the reel per paragraph B, above.
   c. Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.
   d. Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

3. Remove the damaged cable and provide new cable.
4. After the removal of the damaged cable and installation of the new cable:

   a. Test the new cable per the paragraph titled TESTING.
   b. Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether they are new cables installed as part of this project or existing cables installed prior to this project.

1) If any of the cables requiring testing are in use, coordinate with the Owner to schedule an outage opportunity during which the testing can be performed.

c. Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

5. If a cable which occupies the same innerduct or conduit (if not in innerduct) as a damaged cable is damaged by the extraction and installation process, replace the cable at no additional expense to the Owner.

a. Damaged cables which are replaced shall be subject to the testing procedures of the paragraph titled TESTING.

END OF SECTION 271500

SECTION 272500 – EMERGENCY RESPONDER SYSTEM

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

A. Description: For purposes of this specification, a distributed antenna system is an in-building wireless system facilitating frequencies as required by the City of Lakewood and West Pierce Fire and Rescue. It shall be designed to serve as a single broadband radio frequency (RF) infrastructure with the capacity to support a wide range of current and future wireless technologies, protocols, and services. It is able to supply wireless services to multiple applications concurrently. The system antenna design and layout shall be designed and configured for facility location coverage per the 2015 IBC and IFC with all City of Lakewood amendments. Include both VHF and UHF as required.

B. This specification requires the installing contractor to design the system, coordinate all installation requirements with the general and electrical contractors and provide all equipment necessary for a complete and fully functional system. Drawings do not show cabling, raceways, or any other provisions for the system. Contractor shall include all required for the system.

C. The in-building Distributed Antenna System (DAS), “the system”, shall be flexible to accommodate the rapid evolution of wireless technologies and business applications without a major overhaul or upgrade.

D. Provide a complete functional turn-key system, ready for owner’s use.

E. The DAS system shall comply with the following design, coverage and reliability requirements:

1. Signal Handling

a. The system shall have active powered elements that filter and amplify signals on a band specific basis to consistently deliver wireless services at the appropriate power levels. The system shall have the flexibility to support all requested services with separate amplifiers to ensure that the power levels for each band or service may be individually adjusted without disturbing the level of the other services. If active powered elements are not required on the system, the bidder must show engineering details (e.g. power budget) for both upstream and downstream for every required frequency band specified in this specification.

2. Backbone Transport

a. The system may utilize single mode fiber optic interconnects to distribute signals between active devices between floors or building sections.
b. The system may also utilize coaxial cable to distribute signals between floors or building sections.

c. Use only single mode fiber optics for transports for the connection from the roof top source signal donor antennas to the DAS comm. room on the first floor.

3. Broadband Distribution

a. The system shall utilize coaxial cable in the horizontal runs, and passive, broadband antennas in the distribution area. Bidder shall provide antenna specifications, including frequency range, physical dimensions, and electrical specifications, for each antenna proposed.

4. Multiple Services

a. The system shall have the capability of providing different services and power levels across the building in order to provide service flexibility to the end users

5. Backup Power

a. Provide per IFC with 24 hr minimum backup power is required. All DAS electronics shall be provided with battery backup

1.2 CONTRACTOR/INSTALLER

A. Contractor shall have been in business for a minimum of 10 years installing low voltage systems.

B. Contractor shall have completed design and installation a minimum of 3 emergency responder systems

C. Contractor shall have the experience of installing a minimum of (5) wireless networking systems in schools of similar size to this project.

1.3 SERVICE CONTRACT

A. Contractor shall include a 5 year service contract to completely maintain and test the system. This includes all testing for the 5 year period per the International Fire Code

B. Maintenance requirements. The following supplemental instructions apply:

1. SAFETY
2. Contractor must take every effort to ensure safety. This includes having a trusted, professional and experienced team to complete projects as they occur throughout the life of the contract. Contractor shall follow industry standards and laws for health and safety and take all necessary precautions. For equipment, contractors are responsible for ensuring all operators are fully certified and/or licensed and are compliant with all City, County & State laws and regulations in the operation of this equipment.

3. Prior to commencement of work, contractor will supply the University of Washington with a detailed, site-specific safety plan covering fall protection and other safety precautions.

1.4 System Overview

A. Head End

a. The radios DAS head end equipment will be located in the MDF/DAS located in the IDF room of the gym as shown on the drawings.
b. Bidder shall specify and quote the necessary equipment to connect the head end equipment with the equipment located in MDF or IDF's in the building.
c. Provide 19" racks, as necessary.
d. At a minimum, include Bi-Directional Amplifier (BDA) equipment for each of the supported bands, as well as suitable active or passive combining equipment as required combining the multiple signals into a single system.
e. IEEE 802.11 a/b/g/n/ac wireless LAN systems will not be part of the Distributed Antenna System design.
f. The area of the building that requires DAS consists of the entire facility. See the floor plans for exact layout and square footage but the code summary includes the following table. The contractor shall be responsible for confirming exact square footage.

B. Wireless Service Performance

1. The primary role of the DAS system is to ensure public safety radio communications system work in the coverage area. As such, reliability should be a primary goal of the design. The secondary role is to ensure commercial wireless carrier signals work in the coverage area.
2. Signal Sources

a. The external and internal antenna locations must be approved by the owner and design team.
b. The design and topology of all other equipment locations and cable pathways should minimize the impact of any single point of failure.
c. Signal sources shall be coordinated between the wireless carriers and the school district in bringing in the wired circuit, if required.

3. DAS Loading

a. Bidders shall state the assumed DAS RF channel loading and frequency band for each of the wireless operators, and verify that load with the wireless operators in the local market.
   1) Public safety channels for all systems
b. Link Budgets
   1) Bidder shall provide detailed link budgets for each band used by wireless operator that will be injected into the DAS.

2) Bidder shall provide a detailed link budget for each segment of the DAS. 3) Bidder shall provide link budgets for both downstream and upstream within the DAS.

c. Sharing Head End Between Wireless Operators

1) With the exception of the required combining equipment, it is preferred that DAS head end equipment not be shared between radio services or wireless carriers. However, system economics shall have priority over this preference. Bidder shall state where wireless carriers may be required to share equipment, with each other, and with other services or applications.

2) Bidder shall ensure that there are no interferences between systems within the DAS and the Head-end.

4. Coverage Design

a. Provide a minimum system signal level design

1) Coverage inside the building (in all areas) shall exceed 2015 IFC requirements.

5. Modular Scalability

a. The system shall support multiple services in a modular architecture so that services can be added or removed without requiring new infrastructure or disturbing existing services. This architecture shall enable a “pay as you grow” strategy for incrementally adding specific modules if/when new services are required.

C. Service Growth

1. The system shall be capable of expansion to include additional services without requiring additional distribution fiber/cable plant or interior antenna systems. This shall eliminate additional expense and deployment time when new services are required.

2. Service Expansion

a. The system shall be capable of expansion to include additional services

3. Interference

a. Bidder shall guarantee that there will be no interference between the services within the DAS, or between the DAS and wireless carriers specified in this document.

b. Bidder shall describe in detail the methods that have been undertaken with the product to ensure that interference is minimized.

4. Location of Active Elements

a. If Active elements are required, the system shall have all active elements (remote units) located in MDF and IDF.

b. Location of active elements in the ceiling is not acceptable.

D. Other Bid Requirements

1. If fiber optic cable is utilized, Bidder shall specify the final quantities of fiber required, as well as the fiber characteristics required (single mode, multiple mode, loss profile, termination types, etc.) for:

   a. Connectivity between BTS/BDA and head-end, and
   b. Connectivity from head-end to local IDF/hub locations.

2. If coaxial cable is utilized, Bidder shall specify the final quantities of coax required, as well as the coaxial cable characteristics required (cable size, loss profile, termination types, etc.) for:

   a. Connectivity between BTS/BDA and head-end, and
   b. Connectivity from head-end to local IDF/hub locations.

3. Radio System Connectivity:

   a. Bidder shall specify the equipment that the wireless system owners must provide to connect to the DAS system and whether those interfaces will use off-air antennas, BDAs (Bi-directional amplifiers) or a direct connection to a repeater, paging transmitter or BTS (cellular/PCS base station).
   b. Bidder shall also specify how each service named in section 1.2A shall connect to the system.

1.5 MANAGEABILITY

A. The ability for proactive management and end-to-end alarming results in rapid problem identification and resolution. Therefore, it is important that the in-building system be managed. The system shall include a centralized management system and alarm monitoring and notification system. The bidder shall provide a detailed compliance statement for the following requirements.

1. End to End Visibility

   a. The management system shall have the capability to provide end-to-end status information from the headend/BDA/BTS to the remote-end, including the antennas.

2. SNMP Integration

   a. In a hybrid or an active distributed antenna system, the system shall engage with 3rd party SNMP based element management systems and provide fault management information for any active devices that have.

1.6 SUBMITTAL REQUIREMENTS AND PROPOSAL SCHEDULE

A. Submittal Format

1. Respond to all sections in this specification with one of the following responses:

    a. Comply with Specification
    b. Partially comply with Specification
    c. Do not comply with Specification

2. Please provide details on “partial compliance” and “non-compliance” items. For all other section bidder must respond with “Understood Requirements”.
3. All bidders must respond with a softcopy of the response proposal.
4. Responder must not change the original specification in any way or form.
5. Failure to perform the above tasks on the submittal format may be reason for disqualification.

B. Proposal Technical Documentation Design Submittal Requirements

1. The following technical documentation is required as part of this proposal submittal. This documentation will be used by the architectural design team to provision space, cooling, and electrical loads for the components of the internal DAS system, in addition to the shop drawings and specifications detailed in this document. Reference the specifications included in this specification for additional information and requirements.
2. Component List

    a. Provide a summary list of components required for system operation in Excel format. This list must include the part number, line item cost, and a brief description of the component. Immediately following this information, provide information regarding the location where the device is to be installed. Include a column indicating the infrastructure requirements for each component as well, as follows:
        1) Electrical Requirements
        2) Mechanical Requirements
        3) Cabling Requirements
        4) Mounting Requirements

3. System Block Diagram

    a. Provide a block diagram illustrating system components and connectivity requirements.
    b. At a minimum label: cabling requirements, electrical requirements, and related system components. Include a high level diagrams for Comm Room, DAS Room (head end), and rooftop antenna areas or any other related space.

4. Installation and System Support

    a. The installation shall be performed by a company that has been in the business of installing DAS systems for a period of at least three years. The bidder shall provide installation references as required in the request for proposals

b. The Bidder shall fully describe the proposed DAS system support methodology and resources. A baseline support program shall be proposed, which is appropriate to public safety operations.
c. For purposes of evaluating proposals, initial restoration response for remote diagnostics shall be within two hours, on site diagnostics within 8 hours, and parts availability / service restoration within 24 hours.
d. The bidder shall provide installation references as required in the request for proposals
e. The bidder must be factory trained and supported by equipment manufacturer
f. The bidder must have at least one engineer possessing an FCC General Radio Operators License and
g. The bidder must have at least one technician possessing an Electronics certification from NARDA, APCO or ETA in Wireless communications
h. Firm must possess proper calibrated test equipment including a spectrum analyzer or control radio, signal generator and cable sweep analyzer. Instrument operator must hold certification on instrumentation used.

C. Warranty Requirements

1. Provide a sample warranty as part of this submittal for each of the sections detailed below.

a. Hardware Warranty
1) The system selected will require a 5 year parts warranty.
2) All costs associated with extending the parts warranty to the 5 year period will be included in the base system.
3) Any additional service contracts required shall be listed as individual line items.
b. Labor Warranty
1) The system selected shall require a 2 year labor warranty.
2) All costs associated with extending the labor warranty to the 2 year period will be included in the base bid.
3) Any additional service contracts required will be listed as individual line items.

1.7 PROJECT SUBMITTALS AND SHOP DRAWINGS

A. Schedule:

1. Schedule so as to allow sufficient time for submittal review and re-reviews before commencement of work, including material procurement.
2. Allow two weeks for review for each submittal and re-submittal.
3. Incomplete submittals and shop drawings which do not comply with these requirements will be returned for correction, revision and re-submittal.

B. Provide (4) copies of all Submittals and 4 electronic copy of the submittal.

C. Product Submittals:

1. Provide in a three ring binder with hardboard covers.
2. Provide with index and divider tabs by Specification section.
3. Indicate Specification paragraph number on all documents.
4. Review and check all material prior to submittal and stamp "Reviewed and Approved".
5. Submittals shall include:

    a. Product Data for all items provided under this Section.
        1) Indicate materials, finishes, load ratings, dimensions, listings, approvals and attachment methods.
        2) Indicate how the components of an item or system are assembled, interconnected, function together and how they will be installed on the project.
        3) Highlight with yellow or blue marker, or indicate with arrow stamp, adequate information to demonstrate materials being submitted fully comply with contract documents.
        4) Indicate listing by UL or other approved testing agency.
    b. Manufacturers' Cable Installation Instructions

D. Shop Drawings

1. Provide detailed plan views (minimum scale 1/4"=1'-0") and elevations of the DAS room and comm. room showing field conditions, ancillary room components, dimensions, equipment racks, termination blocks, patch panels, cable paths and workspace requirements for access to equipment and cable connections.
2. Ratings of items.
3. Coordinate with other division shop drawings and submittals. Identify interface points and indicate method of connection.
4. Provide drawings to show evidence of coordination with other trades.
5. Provide plan drawings of each floor of each building showing:

    a. Routing for all cables installed under this Work.
    b. Pathways of all cable supports with part number, total capacity, and installed capacity for each support or run of supports.
    c. Antenna locations

6. Reports and Schedules

    a. Provide Cable Termination Schedules for all cables installed under this work, with the following information:
        1) Backbone cables (riser)
        2) Horizontal (antenna) distribution cables
        3) Provide sample reports showing the proposed format for cable test reports.
        4) Provide a construction schedule showing the various work tasks, time periods, duration and staffing requirements.

E. Product Data: For each type of product indicated.

1. For coaxial and fiber optic cable, include the following installation data for each type used:

   a. Nominal Optical Density (OD) (if applicable).
   b. Minimum bending radius.
   c. Maximum pulling tension.

F. The Contractor agrees:

1. Submittals and shop drawings processed by the Architect or Owner are not change orders.
2. The purpose of submittals and shop drawings by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept.
3. Submittals demonstrate equipment and material Contractor intends to furnish and install and indicate detailing fabrication and installation methods Contractor intends to use.
4. To accept all responsibility for assuring that all materials furnished under this Specification meet, in full, all requirements of the contract documents.

G. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Corrections or comments made during this review do not relieve contractor from compliance with the requirements of the drawings and specifications. Contractor is responsible for:

1. Dimensions which shall be confirmed and correlated at the job site.
2. Fabrication process and techniques of construction.
3. Coordination of his work with that of all other trades.
4. Performing his work in a safe and satisfactory manner.
5. All Manufacturers' Instructions (including cable installation instructions)

PART 2 - MATERIALS

2.1 EQUIPMENT MANUFACTURERS

A. All equipment shall be the product of a manufacturer that has been in the business of manufacturing like product and financially stable for a period of at least five years. The bidder shall provide equipment references as required in the request for proposals. Commscope Andrew is an approved manufacturer.

B. The Bidder shall commit, in writing, to factory support for the primary components of the DAS system, providing hardware availability and support for a minimum period of ten years following system implementation.

2.2 PARTS AND EQUIPMENT SPECIFICATIONS

A. Bidder shall provide parts and equipment list, and specifications for all components of the system, including, but not limited to:

1. Shielded Coaxial Cable and connectors

2. Fiber Optic cable and connectors
3. Optical and coaxial splitters and terminators
4. Interior Antennas
5. Donor antennas
6. Splitter/Taps/Couplers for the DAS
7. Radios, amplifiers, head end equipment, combiners
8. Combining equipment at the Head End

2.3 SPARE MATERIALS

A. Furnish spare materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide not less than one of each item listed below. Deliver extra materials to Owner.

1. Antennas: One of each type installed.
2. Active modules: One of each type installed.
3. Passive Components (taps, combiners, splitters, couplers, etc.): One of each type installed.
4. Cable: 100 feet (30 m); each type used
5. Jumper Cables: Two for every type installed.

PART 3 - EXECUTION

3.1 COORDINATION

A. Design coordination is required for this Work. Coordination with General Contractor and the design team is required to address system integration and structure cabling design. Initial coordination meetings will be setup by the General Contractor and Owner.

B. Coordinate Work of this Section with on-site General Contractor and their sub-contractors. Initial coordination meetings will be setup by the General Contractor and Owner.

C. Coordinate layout and installation of distributed antenna system equipment and antenna cable with other construction that penetrates ceilings or is supported by them, including but not limited to light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

D. Coordinate location of cabling and antennas with other trades.

E. Coordinate location of equipment in the comm. rooms and spaces with the design team, Owner and the cable contractor.

F. Coordinate installation and system level measurement with design team, head-end electronics vendors and installation contractors.

G. Coordinate with the local public safety jurisdiction and secure "Approval to Carry" letter from the owner of each public safety radio system carried by the DAS. If multiple systems are covered, approval from each carrier is required.

H. Coordinate and verify with wireless carriers on the project specific electrical branch circuit requirements and power connection requirement (hard-wired or NEMA receptacle/plug type) based upon the wireless carriers' project specific equipment requirements. Also coordinate these requirements with the electrical contractor of this project.

I. Coordinate work of this Section with the requirements of each wireless service carrier. (early coordination has been attempted, please review Attachment B)

3.2 CABLE INSTALLATION

A. When possible, fiber optic cables, coaxial cable, and other associated cable and wiring shall be installed along the side of existing cable trays, in conduits, or attached to walls and ceiling.

B. Coaxial cables are to be terminated at bulkheads in each designated equipment room. Provide proper grounding on each bulkhead.

C. All cabling and antennas installed shall avoid damage to any post-tensioned decks and beams.

D. All installed cable shall be labeled "DISTRIBUTED ANTENNA SYSTEM CABLE" every twenty feet.

E. Contractor will provide as-built documentation of the installed cable system to owner and design team.

3.3 TESTING

A. Bidder shall provide detailed documentation specifying test procedures for installed cabling, antennas, radios, amplifiers, coverage, and management system.

B. Acceptance Testing Procedure

1. Upon completion of system, test to ensure that two-way communications coverage on each floor of the building meets the specified performance requirements.
2. Signal level measurements shall be made at two locations within each grid using a standard dipole antenna tuned a maximum of two nonadjacent areas will be allowed to fail the test by not meeting the minimum signal levels established.
3. In the event that three of the grids fail the test, in order to be more statistically accurate, the floor may be divided into 40 equal areas. In such an event, a maximum of two nonadjacent areas will be allowed to fail the test. After the 40 grid test, if the system continues to fail, the vendor shall alter the system to meet the coverage requirement.
4. Testing of stairwells and non-enclosed areas shall be performed as separate tests with statistics gathered separately for signal levels in the primary structure and parking areas. Signal levels shall meet the requirements for all areas enclosed by the structure and statistical methods shall not be used to dilute the intent of the coverage requirements.

C. Bidder shall perform cable testing for all install cables for the DAS.

1. FDR testing for the horizontal and vertical coaxial cables
2. OTDR testing for any fiber optic cables.

D. Provide copies of test results to General contractor

3.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of distributed antenna systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Bidder or installer will provide documentation indicating this prior experience.

END OF SECTION 272500

SECTION 275123 - INTERCOM/CLOCK/PROGRAM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a Bogen TPU paging system connected to the building phone system

1.2 SCOPE Of WORK

A. The intended scope of work for these specifications is for the installation of an paging system. All headend and peripheral equipment shall be provided and installed by a Contractor that is Factory Certified in the same type system as being furnished. Upon request, a copy of the Factory Certification paperwork issued by the Manufacture shall be forwarded to the Engineer. Provide all equipment necessary for a complete and fully functional paging system

B. Prior to installation, the Systems Contractor shall be completely familiar with the existing data network. The Contractor shall have worked with the Owners IT department to ensure the proper network conditioning and configuration has been performed.

C. Installer must be a certified factory installer

1.3 CODES AND STANDARDS

A. All wiring shall be in accordance with the requirements of Article 725 of the National Electrical Code for Class 2 Signaling Systems, applicable local codes and manufacturer's wiring diagrams.

1.4 INTEGRATION WITH TELEPHONE SYSTEM

A. Interface to the owner’s paging system

B. Logical Topology: Access to the paging system from the telephone system shall be restricted to “Administrator” telephones. One trunk on the paging system shall access the control privileges. The telephone system shall restrict which telephones can call into that paging trunk. Telephone instruments will be provided by the Owner. Telephone instruments shall be connected to the building telephone switch. System integration shall be provided under this Section.

1.5 FUNCTIONS - INTERNAL COMMUNICATIONS

A. The paging system shall provide at least the following features and functions plus any additional standard features. The system shall contain the software and hardware for a loud speaking paging system. Systems that rely upon unique or specially developed circuitry for an individual or unique application shall not be acceptable under the intent of this specification.

B. Provide for paging access from administrative area multi-line telephones, and authorized staff and classroom telephone stations.

C. Provide direct dialing loudspeaker communication between all locations equipped with multi-line telephones, staff telephones, and staff loudspeakers.

PART 2 - EQUIPMENT

2.1 CONTROL CENTER CONSOLE

A. The control center console housing shall be contained in a wall mounted enclosure which shall measure 24" x 32" x9" or directly to plywood

2.2 TELEPHONE INTERFACE DEVICE

A. The telephone-access voice-paging adapter shall be a Bogen Model TAMB2 (or TAMB2PS) capable of providing either trunk port or station port access to paging amplifier, multi-zone paging adapter, or talk back amplifiers. The adapter shall have station port compatibility, 2-wire analog with a ringer equivalence number of 1.3B, and trunk port compatibility with 2-wire loop start or ground start. The paging frequency response shall be 200 Hz to 8000 Hz, ±1 dB, and the input/output impedance shall be 600 ohms, nominal. All operational modes require the unit to be supplied with 24V DC @ 150mA max draw. Reversal of the power supply connection polarity will not damage the unit. The unit shall be capable of generating an 800 Hz (± 20%), 1/2-second duration signal to be used as a pre-announce or confirmation tone; the tone level shall be controlled by an adjustment that shall be accessible without removing the cover. When used in the station access mode, the device shall be capable of three methods of release following a page: (1) Loop Current Interruption CPC Pulse, (2) Voice-Operated Disconnect, and (3) Default Disconnect Timer. The loop current interruption detection circuit shall, if the particular line to which the device is connected issues a disconnect signal (a loss of loop current for longer than 30 milliseconds), recognize this signal and immediately disconnect the device from the line. The voice-operated disconnect circuit shall be enabled/disabled via mode switches or an external signal. A default disconnect timer circuit shall set the maximum time allotment for paging and ensure that the unit will always disengage the line if the other disconnect circuits are inoperative. The default disconnect timer duration shall be adjustable from 1 to 200 seconds and the VOX disconnect timer duration shall be adjustable from 1 to 11 seconds. Time duration is controlled using DIP switches and rotary controls. Both timers can be independently inhibited. When used in the trunk port access mode, the device shall automatically terminate paging access upon release of the trunk port. A stereo combining RCA-type input shall be included to accept a line-level input from a suitable background music source. A control shall be provided to set the background music volume. One C-Form (N.O. and N.C.) set of contacts shall be provided for use with auxiliary equipment. The contacts shall be rated at 30V DC, 2A/125V AC, 0.6A /110V DC, 0.6A (resistive). The device shall be mounted in a steel enclosure and finished in black enamel with white lettering. It shall be listed to UL standard 60950 and comply with Part 68 of FCC Rules and Regulations. Capable of wall-mount, single-unit rack mount (with optional rack kit), or side-by-side dual-unit rack mount. Power supply is required for TAMB2PS.

2.3 ZONE PAGE AND AUDIO PROGRAM POWER AMPLIFIER

A. The amplifier shall be capable of an audio output of 60, 100 or 250 / watts at less than 2% distortion (70 Hz to 12 kHz).

B. Bogen TPU

2.4 CONE SPEAKER/TRANSFORMER ASSEMBLY

A. The speaker shall be an 8" permanent magnet cone-type having a viscous-damped cone, and a ceramic magnet weighing at least 6 ounces.

B. The speaker assembly shall be equipped with a dual-winding (25-volt/70-volt) line matching transformer. It shall provide 1/8, 1/4, 1/2, 1, 2 and 4 watt power taps for both 25-volt and 70-volt operation.

C. Bogen S86

2.5 CEILING-MOUNTED ROUND GRILLE/ENCLOSURE

A. The round speaker grille shall be constructed of steel. The finish shall be a hard baked semi-gloss white enamel. The grille shall have a diameter of 12-3/4", and shall be designed to accommodate a standard 8" loudspeaker.

1. Model PG8W

B. The metal protective enclosure shall have a plaster flange external to the enclosure, with a grille-mounting flange internal to the enclosure. The enclosure shall have four combinations 1/2" to 3/4" conduit knockouts.

1. Model RE84.

2.6 WALL-MOUNTED SQUARE GRILLE/ENCLOSURE

A. The square speaker grille shall be constructed of heavy gauge cold rolled steel, and shall have a baked enamel finish. The grille shall have a square opening with a separate sub-plate for mounting to an enclosure.

B. The grille shall be 12-5/8" square. The grille shall accommodate an 8" loudspeaker.

1. Model SG-8.

C. The grille shall be mounted to a metal protective enclosure constructed of heavy gauge cold rolled steel with the interior undercoated and jute patch lined to prevent mechanical and acoustical resonance.

1. Model RE1175.

2.7 ACCESSORIES

A. Volume Control

B. SURGE PROTECTOR: Provide over voltage and transient spike surge protector to condition AC voltages into all microprocessed control systems. 253-MPI.

PART 3 - INSTALLATION

3.1 CABLE

A. Paging cable shall be shielded twisted pair, plenum rated, gray color.

1. NOTE: The above cabling shall be spliced in junction boxes, device boxes, or terminal cabinets. In-line splices are not permitted.

B. Cable shall be terminated on 110 blocks.

C. A fire proof plywood backboard shall be provided at the telephone entrance and PBX location for wall mounted systems. Wiring shall be identified by room number, segregated, neatly laced, and terminated on telephone punch-on blocks. Cabling between control center console, the paging backboard, and PBX shall be provided with telephone-type connectors to allow ease in connections, disconnections, and service.

D. A minimum 24" wide by 24" high by 3/4" deep terminal backboard shall be installed in the wall at the rear of the intercom console if a rack-mounted system is provided. A fire proof painted ' plywood backboard shall be provided at the telephone entrance and PBX location for wall mounted systems. Wiring shall be identified by room number, segregated, neatly laced, and terminated on telephone punch-on blocks. Cabling between control center console, the paging backboard, and PBX shall be provided with telephone-type connectors to allow ease in connections, disconnections, and service.

3.2 INSTRUCTION AND MAINTENANCE MANUALS

A. A minimum of four hours of time shall be included in the bid for instruction of the personnel designated by the Owner as to the correct operation of the system.

B. Upon completion of the installation, the Contractor shall furnish the Owner with three system manuals each containing the following where applicable. Operating instructions and maintenance manuals of all equipment.

3.3 SPARE PARTS

A. Provide the following spare parts

1. 2 Ceiling speakers with baffle, back box, and mounting

3.4 GUARANTEE AND MAINTENANCE

A. A two-year warranty covering all components, equipment, and workmanship shall be submitted in writing with system documentation. The warranty period shall begin on the system's first use by the school.

B. Should any trouble develop within this two-year period due to inferior or faulty material and/or workmanship the Contractor shall promptly make all required corrections without cost to the Owner.

END OF SECTION 275123

SECTION 28 08 00 – COMMISSIONING OF ELECTRONIC SAFETY & SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following sections specify commissioning activities for this project:

01 91 13 – General Commissioning Requirements

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Fire Alarm

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified Section 01 91 13, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Fire Alarm						
Polarity, continuity & grounding verification						
Device and system point to point checks						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

SAMPLE
Fire Alarm System
Contractor Checklist

Location: **Area/Room Served:**
Manufacturer: **Model:**

Check	RC	CxA	Note
Equipment			
Fire alarm panel mounted per project documents, service accessible.			
Remote annunciation devices installed per project documents.			
Graphic annunciation panel installed per project documents.			
Panels are labeled per project documents.			
Wiring, terminations, patch panels, cross-blocks have been labeled per the project requirements.			
Grounding and bonding procedures completed per the project requirements.			
Wiring installed in conduit per the project requirements.			
Detection and alarm devices installed per project documents			
Detection and alarm devices labeled with device number/address.			
Emergency power circuit provided to maintain system operation during power outages.			
Maintenance free batteries provided and sized to provide required system back-up and alarm functions.			
Modem or network communication device connected			
Start-Up			
CxA notified for witness of preliminary testing			
Manufacturer's installation and start-up procedures complete.			
Start-up documentation submitted to CxA.			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor will be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that will be conducted on this project. This table will be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table will be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A	B	C	D	E	F	G
	Responsible Contractor	**Proposed Test Forms Received**	**OK**	**Testing Complete**	**OK**	**Notes**
Fire Alarm						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Fire Alarm System
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Appendix B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
A.1	Contractor	Contractor	N/A	100%

Note: These tests to take place prior to demonstration to Authority Having Jurisdiction

Functional Tests:

1) Wiring
   a) Grounding resistance
   b) Absence of voltage.
   c) Polarity
   d) Short circuits.
   e) Circuit resistance.

2) System Tests
   a) FAP Feature demonstration.
   b) Input device reporting
   c) Output device operation and reporting
   d) FAP System Trouble.
   e) Initiating and indicating circuit and device trouble alarms
   f) Dial up
   g) Secondary power operation.
   h) Battery capacity
   i) Reporting interface point-to-point and mapping
   j) Audible levels, strobe levels

PART 4 – SAMPLE FUNCTIONAL TEST DOCUMENTS

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that will be required from the contractor. These forms and procedures will be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that will be required to be executed by the contractor.

The following tests may be supplanted by Fire Alarm Contractor test forms as appropriate and compliant with test requirements.

Sample Draft Functional Performance Test
Fire Alarm Wiring Continuity, Polarity and Grounding Static Tests

1. Prior to connecting any devices the wiring system is to be verified.
2. Record Zone or Circuit Number for each unique zone/circuit
3. Verify circuit continuity, polarity and grounding

Criteria: A – Continuity, B - Polarity, C - Grounding

Zone/ Circuit	Description	A	B	C	Comment

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Fire Alarm Functional Performance Testing

Functional Performance Test Summary Table:

Test No.	Test Name	Status
FA-1	FAP Feature Demonstration	
FA-2	FA Input Device Reporting	
FA-3	FA Output Device Operation	
FA-4	Fire Alarm/Trouble Reporting	
FA-5	Phone Line Monitoring	
FA-6	Initiation Circuit and Device Trouble	
FA-7	Battery Operation	

Preparation:

1. Using the field drawings, identify each fire alarm input and output device with a unique number.
2. Enter all devices into the fire alarm input and output device data sheets. Use the provided key for labeling and identifying.
3. Perform these tests while the building is generally unoccupied with one operator at the fire alarm control panel and one in at the fire alarm input devices.
4. Notify alarm monitoring company that a fire alarm test will be conducted.

Fire Alarm System Labeling Key

Abr.	Input Device	Abr.	Output Device
PS	Pull Station	H	Horn
SD	Smoke Detector	S	Strobe
DD	Duct Detector	HS	Horn/Strobe
HD	Heat Detector	MH	Magnetic Holder
FF	Fire Flow (sprinkler)	B	Bell
FT	Fire Tamper (sprinkler)	AUX	Auxiliary (HVAC tie in, etc.)
FS	Fire Suppression (kit. hood etc.)	FD	Fire and smoke dampers
		D	Dialer to monitoring

Sample Draft Functional Performance Test
Test FA-1: Fire Alarm Feature Demonstration

Systems to be Tested:

1. Fire alarm panel

Test Objective and Success Criteria:

1. Verify all features and functions have been provided or programmed per project documents.

Preparation:

1. All start-up activities, static testing, calibration is complete

Equipment:

1. Accurate watch or clock.

Procedures:

1. Demonstrate that all features and functions are included and programmed correctly.

Functional Performance Test Data Sheet
Test FA-1: Feature Demonstration

Test Date: ☐ **Test Time:** ☐

Test	OK	Comment
Sensitivity testing - display and print sensor sensitivity		
Automatic monthly sensitivity report - demonstrate setup and printout		
Cleaning required report - demonstrate cleaning report, adjust sensitivity thresholds if necessary.		
Sensitivity scheduling - demonstrate scheduling capability		
Day light savings adjust - demonstrate feature		
Leap year adjust - demonstrate feature		
History logging		
Battery charger mode displayed at panel		
Walk test mode		

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-2: Fire Alarm Input Device Reporting

Systems to be Tested:

1. All fire alarm input devices including, but not limited to:
    a. Smoke detectors
    b. Duct smoke detectors
    c. Heat detectors
    d. Manual pull stations
    e. Fire sprinkler flow
    f. Fire sprinkler tamper switches
    g. Fire suppression system activation

Test Objective and Success Criteria:

1. Verify all input devices activate the appropriate alarm/trouble signal.
2. Verify all devices report the correct zone, device and address at the fire alarm panel display, printer and monitoring company/system.

Preparation:

1. All start-up activities, static testing, calibration is complete.
2. Input/output devices identified on plans.

Equipment:

1. Magnet
2. Artificial smoke

Procedures:

1. One at time, activate the individual fire alarm input device by simulating an alarm condition for the type of device.
2. For smoke detectors use magnet to trip alarm if so equipped, otherwise use canned smoke.
3. For heat detectors, use magnet to trip alarm if so equipped, otherwise use heat lamp.
4. For tamper switches, close valve partially to create alarm, do not manipulate switch. To clear, open valve all the way.
5. For deluge or purge suppression systems, the system typically cannot be tripped without damaging systems and equipment. Use that systems test mode to simulate alarm.
6. Verify the system goes into fire/trouble alarm and annunciates the appropriate message at the panel and at the printer, record message and data in the Fire Alarm Input Device Test Form. If printout is available, it may be marked up and used instead of the data form.
7. If the fire alarm system is capable and configured to communicate specific data for the zone or sensor in alarm, the Fire Alarm Input Device Form is to be completed for both the local alarm reporting and for the monitoring company/system.
8. Reset the fire alarm and verify the fire alarm clears. Record data.
9. Repeat for all devices.

Functional Performance Test Data Sheet
Test FA-2: Fire Alarm Input Device Reporting

Test Date: ☐ **Test Time:** ☐

Dwg #	Loc	Type	Address	Zone Description	A	Annunciation Displayed	C	Comment

A=Alarm Received C=Alarm Cleared

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-3: Fire Alarm Output Device Operation

Systems to be Tested:

1. All fire alarm output devices including, but not limited to:
    a. Horns & bells
    b. Strobes
    c. Magnetic door releases
    d. Autodialer/communications
    e. Auxiliary outputs (HVAC, etc.)
    f. Motorized fire/smoke dampers

Test Objective and Success Criteria:

1. Verify all output devices activate per design; horns/bells sound, strobes flash, doors release, HVAC shuts down, dampers close.
2. Verify all horn/bell audible levels meet specified output in db per project documents.
3. Verify all strobe lighting levels meet specified output in lumens per project documents.
4. Verify all output devices activate within the required time period per project documents.

Preparation:

1. All start-up activities, static testing, calibration is complete.
2. Input/output devices identified on plans.
3. Access to HVAC control system.

Equipment:

1. Sound meter
2. Light meter
3. Time keeping device

Procedures:

1. Activate fire alarm.
2. Verify all output devices operate per design (horns/bells sound, strobes flash, magnetic doors release, fire/smoke dampers close, auxiliary relays close), record test information on the Fire Alarm Output Device Test form.
3. Measure performance parameters for output devices as required by project documents (horn sound level in db, strobe light level, activation times). Record data on Fire Alarm Output Device Test Form.
4. Silence and reset fire alarm.

Functional Performance Test Data Sheet
Test FA-3: Fire Alarm Output Device Operation

A=Activated or Annunciated - Horn, Bell, Strobe, Magnetic Hold, etc.
P=Printed - Alarm printed out.
MP= Measured Performance - db for audible, lumens for strobes, etc.

Test Date: ☐ **Test Time:** ☐

Dwg #	Loc	Type	Address	Zone Description	A	P	MP	Comment

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-4: Fire Alarm/Trouble Reporting

Systems to be Tested:

1. All fire alarm panels

Test Objective and Success Criteria:

1. Verify all alarm/trouble/supervisory signals the system is capable and configured for report to the fire alarm panel and the alarm monitoring company/system.

Preparation:

1. All start-up activities, static testing, calibration is complete.
2. Alarm monitoring company/system notified of tests.

Equipment:

1. Time keeping device.

Procedures:

1. Synchronize time keeping with alarm monitoring company/system.
2. For each type of alarm reporting the system is capable and configured for (fire alarm, supervisory, trouble, AC failure etc.) simulate an alarm or trouble condition, record time alarm/trouble was activated. If Test FA-2 included individual zone reporting to monitoring company/system then only supervisor and trouble alarms need to be tested here. Note: There are separate functional tests FA-5 & FA-6 that test phone line failure and initiation circuit failures, these can be conducted at the same time.
3. Verify panel reports alarm/trouble and buzzer sounds.
4. Verify the alarm monitoring company/system receives the alarm/trouble within the specified time.
5. Clear alarm/trouble.
6. Verify alarm monitoring company/system receives the clear signal.

Functional Performance Test Data Sheet
Test FA-4: Fire Alarm/Trouble Reporting

Test Date: ☐ **Test Time:** ☐

Alarm/Trouble	Time Activated	Time Received	OK	Clear OK	Comment
General Fire					
Supervisory					
Trouble					
AC failure					
Phone line					
Initiation circuit					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-5: Phone Line Monitoring

Systems to be Tested:

1. All fire alarm panels.

Test Objective and Success Criteria:

1. Verify secondary line picks up on primary line failure and reports to the fire alarm panel monitoring company/system.
2. Verify secondary line failure reports to the fire alarm panel and the monitoring company/system

Preparation:

1. All start-up activities, static testing, calibration is complete.

Equipment:

1. None.

Procedures:

1. Verify all systems are normal.
2. Disconnect the secondary phone line
3. Verify trouble condition reports at panel, buzzer sounds and trouble is reported to the alarm monitoring company/system.
4. Reconnect secondary phone line.
5. Verify trouble alarm clears, silence buzzer.
6. Repeat steps 2-5 for primary phone line.

Functional Performance Test Data Sheet
Test FA-5: Phone Line Monitoring

Test Date: ☐ **Test Time:** ☐

Phone Line Failed	Time Activated	Time Received	OK	Clear OK	Comment
Secondary					
Primary					

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-6: Initiating Circuit and Device Trouble Test

Systems to be Tested:

1. All fire alarm panels and initiating circuits.

Test Objective and Success Criteria:

1. Verify all initiating circuits report a trouble conditions for all specified failure modes, including, but not limited to:

Preparation:

1. All start-up activities, static testing, calibration is complete.

Equipment:

1. Jumper wires
2. Hand tools

Procedures:

1. Conduct the following tests for each unique initiating circuits. For each test, verify that the trouble is received and correctly reported at the fire alarm panel. If the system is capable and configured to report the specific alarm to the monitoring company/system, then the form is to be completed for both the FAP and the monitoring system.
2. Create a ground fault.
3. Create a short circuit.
4. Create an open circuit.
5. Remove a device.
6. Address two devices the same.

Functional Performance Test Data Sheet
Test FA-6: Initiating Circuit and Device Trouble

Test Date: ☐ **Test Time:** ☐

Circuit #:

Circuit/Device Trouble	A	Annunciation Displayed	C	Comment
Ground Fault				
Short Circuit				
Open Circuit				
Missing Device				
Duplicate Address				

Circuit #:

Circuit/Device Trouble	A	Annunciation Displayed	C	Comment
Ground Fault				
Short Circuit				
Open Circuit				
Missing Device				
Duplicate Address				

Circuit #:

Circuit/Device Trouble	A	Annunciation Displayed	C	Comment
Ground Fault				
Short Circuit				
Open Circuit				
Missing Device				
Duplicate Address				

A=Alarm Received C=Alarm Cleared

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

Sample Draft Functional Performance Test
Test FA-7: Battery Operation

Systems to be Tested:

1. All fire alarm panels and associated battery systems

Test Objective and Success Criteria:

1. Verify fire alarm system can operate on back-up battery power after an AC power failure for the specified time period.
2. Verify trickle charge system is functional.

Preparation:

1. All start-up activities, static testing, calibration is complete.

Equipment:

1. Time keeping device.

Procedures:

1. Perform test with building unoccupied or with a fire watch.
2. Conduct the test when batteries have been fully charged.
3. Record battery charger status from display (volts/amps).
4. Disconnect AC power to fire panel.
5. Verify panel goes into trouble, buzzer sounds.
6. Silence panel alarm.
7. Allow fire alarm system to run for the specified length of time in supervisory mode.
8. At the end of the supervisory mode period, set off fire alarm, do not silence.
9. Verify fire alarm activates and all output devices operate for the specified period of time.
10. Clear alarms, reset panel
11. Reinstate AC power and immediately record battery charger status from display.
12. Wait the specified charge period then record battery charger status from display. Verify trickle charge is operational by noting a decrease in charging current.

Functional Performance Test Data Sheet
Test FA-7: Battery Operation

Test Date: ☐ **Test Time:** ☐

24 Hrs	Duration for operation on batteries in supervisory mode.
5 Min	Duration for operation on batteries in alarm mode.
	Duration for battery charge test.

Battery charger volts/amps prior to test	
Date/Time of AC power failure	
Panel in AC trouble, buzzer silenced	
Date/Time of fire alarm	
Time fire alarm cleared	
All output devices operated for specified period	
Time AC power restored	
Battery charger volts/amps	
All systems normal	
Date/Time battery status checked after charging	
Battery charger volts/amps	
Trickle charge OK	

☐ Fire alarm reset and normal.
☐ Notify alarm monitoring company that all testing is complete.
☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
GC Cx Coordinator:			

END OF SECTION 280800

SECTION 281300 – ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide a complete and fully operation Access Control system integrated to the Honeywell Vista Security System

1.2 INSTALLER QUALIFICATIONS

A. Systems Integrator must be a current Open Options manufacturer authorized installer.

1. Systems Integrator must have been in business for 10+ years in the Electronic Security Industry and completed at least 3 schools with this product.
2. Systems Integrator must have a fully staffed (installation and service department) office within a 90 mile radius of Bellingham School District Administrative Office
3. Systems Integrator must have a min of (2) fulltime service technicians and (6) installation technicians working/dispatched from office within a 90 mile radius of NSDA.
4. Systems Integrator must have the ability to offer remote monitored and managed services to include:

    a. Patch Management
    b. Endpoint Security
    c. Monitoring of System Health
    d. Asset Auditing/Inventory
    e. Remote PC Backup and Restoral
    f. Done over an Ethernet connection utilizing a 256-bit RC4 using a rolling key for extreme security measures.

5. Certification

    a. Project manager must have completed all certified courses for the product line. Include copy of compliance with submittals.

B. Installer must be the same for security and access control

1.3 DEFINITIONS

A. API: Application Programming Interface.

B. LDAP: Lightweight Directory Access Protocol.

C. NTSC: National Television Standards Committee.

D. PAL: Phase Alternating Line. PAL is the color video standard used in Europe and many other countries.

E. SMS: Security Management System.

1.4 REFERENCE STANDARDS

A. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.

B. Electronic Industries Alliance (EIA):

1. EIA RS-170 - Standard for Composite Video Signals.

C. Federal Communications Commission (FCC).

1. FCC Part 15 - Unlicensed RF Devices.
2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network. F. Institute of Electrical and Electronics Engineers, Inc. (IEEE).

D. International Organization for Standardization (ISO). H. International Radio Consultive Committee (CCIR).

E. Microsoft® Open Database Connectivity (ODBC) Interface.

F. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

G. National Institute of Standards and Technology (NIST):

1. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).

H. National Television Standards Committee (NTSC):

1. Color Camera Broadcast Standard.

I. Underwriters Laboratories Inc. (UL):

1. UL 294 - Standard for Access Control System Units.
2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.

1.5 SECURITY MANAGEMENT SYSTEM (SMS)

A. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms and; view, record and store digital surveillance video linked to SMS events.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.

1. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.
2. A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:

a. Server(s) processor(s), disk space and memory size.
b. Description of site equipment and its configuration.
c. Network bandwidth, latency and reliability requirements.
d. Backup or archive system size and configuration.
e. Start up operations.
f. System expansion capability and method of implementation.
g. System power requirements and UPS sizing.
h. Device or component environmental requirements (cooling and or heating
i. parameters).
j. A description of the operating system and application software.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.

1. Indicate all system device locations on architectural floor plans. No other system(s) shall be included on these plans.
2. Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.
3. Include a complete SMS one-line, block diagram.
4. Include a statement of the system sequence of operation.

C. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:

1. Provide 5 sets electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
2. Manuals: Deliver final copies of the manuals after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:

    a. Functional Design Manual: Identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Include a description of hardware and software functions, interfaces, and requirements.
    b. Hardware Manual: Describe equipment furnished including:
        1) General description and specifications.
        2) Installation and check out procedures.
        3) Equipment layout and electrical schematics to the component level.
        4) System layout drawings and schematics.
        5) Alignment and calibration procedures.
        6) Manufacturer's repair parts list indicating sources of supply.
    c. Software Manuals: Describe the functions of software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
        1) Definition of terms and functions.
        2) System use and application software.
        3) Initialization, startup, and exit.
        4) Reports generation.
        5) Details on forms customization and field parameters.

3. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DXF format.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher

sophistication and complexity as compared to the system detailed in this specification.

2. SMS manufacturer shall employ at a minimum the following methods for quality assurance of component and assembly devices.

   a. Perform visual inspection of devices to verify assembly according to defined procedures. Perform end of line operational tests to ensure product functionality has been correctly configured.

3. Perform individual functionality and system level regression testing to ensure compliance with product specifications. Perform single and multiple unit system tests to mimic end-user installation configurations. Utilize automated hardware and software testing to evaluate system performance under published operational loads and compare to published system capabilities.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store components and equipment in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degrees Fahrenheit (10 and 29.4 degrees Celsius), and not more than 80 percent relative humidity, non-condensing.

C. Open each package; verify contents against packing list; and file copy of packing list, complete with package identification, for inclusion in operation and maintenance data.

D. Mark packing list with the same designations assigned to materials, components, and equipment for recording in the system labeling schedules that are generated by software.

E. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Equipment and Components: Rated for continuous operation in ambient conditions of 60 to 85 degrees Fahrenheit (15.5 and 29.4 degrees Celsius) and a relative humidity of 20 to 80 percent, non-condensing.
2. Indoor Environment: NEMA 250, Type 1 enclosure.
3. Outdoor Environment: NEMA 250, NEMA 250, Type 4 enclosures.

1.10 WARRANTY

A. SMS, Third-party, and Access Control Warranty:

1. SMS manufacturer warrants that the product disc and hardware key shall be free from defects in material and workmanship and that SMS software product will function in substantial accordance to SMS manufacturer's specifications. Any defective dongle will be replaced at no charge provided that the system is currently on a supported version of SMS software. Dongles for non-supported versions will be replaced for a cost.
2. All SMS manufacturer branded access control hardware is provided with a three (3) year warranty from the date of project substantial completion. SMS manufacturer warrants that such products will be free from defects in material and workmanship and that they will operate in general accordance with their product specifications. The parts will be repaired or replaced at the manufacturer's option. Reseller shall follow SMS manufacturer's procedures for RMA with these products. SMS manufacturer provides repair or replacement of SMS manufacturer branded components for up to five years from the product discontinuance date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer List: Open Options, Inc. 3440 Sojourn Drive Suite 240 Carrolton TX 75006 (972) 818-7001

2.2 There shall be no substitutions to Open Options, Inc.SMS SOFTWARE

A. Provide complete and up to date Security Management System (SMS) Software for all 4 sites: Open Options DNA, Lenel Systems International. "OnGuard" Series ADV, Bosch Ready Key Pro. System shall be provided completely to accommodate this project. Include all components necessary for a complete and fully operational access control system.

2.3 SERVER

A. Server: Provide server for the district to run the system. The server shall be mounted in the High School MDF room or as directed by the district. Server shall contain all hardware and software required for a complete and fully function system. The minimum server specifications are as follows:

1. Processor Speed: Intel Core i7 2.8 GHz or greater
2. Multi-Processor: Dual Processors
3. System Memory (RAM): 16 GB

4. Network Card: 1 Gbps
5. Hard Drive Size: (1)512 GB solid state drive with operating system.
6. Graphics Card: 1 GB, separate
7. CDRW Drive
8. Operating System: Windows 8 or 2012 Server or as required.
9. Redundant Power Supply
10. UPS (Uninterrupted Power Supply)
11. Dell Precision or Equal

2.4 Equipment

A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294

B. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components:

1. System Processor - SSP
2. Controller - part # (Dcontroller/x-ISC-16, OSC-16)
3. Reader Modules (dual reader modules) - part # (RSC-1/2)
4. Ethernet Interface (NSC-100),
5. Enclosure and power supply - part # LNL-600ULX-4CB6
6. Altronix Lock Power Supply - part # AL600ULXPD16CB
7. Battery backup for all power supplies shall be- Yuasa - MP7-12
8. Lenel part # SWC-ADV –
9. Server and CLIENT Software and all licenses
10. Proximity Reader – HID I-Class part # ARD-R40 or R15 Mullion tye
11. Door Position Switch: GE/UTC 1076CW-N (RECESSED STEEL DOOR CONTACT W/WIRE LEADS 3/4” DIAMETER WIDE GAP SPDT WHITE)
12. Request to Exit Kantech REX part # T-REX-XL. with Kantech REX Plate part # T-REX-PLATE
13. Cards: Provide 300 School District standard proximity cards/fobs with this project. Type as directed by the owner.. Fully program system for each card. Provide demonstrations of all options to owner prior to ordering
14. Electric Locks: Coordinate with hardware specification
15. ADA Doors: Provide relays required to interface to ADA automatic door systems.
16. OptoHub 485 Multiplexers
17. Siren: Provide horn at each master station to indicate door open.
18. Pushbutton. Provide pushbutton at each master station to unlock door. Bosch ND
19. Door Alarm Station: Provide interface to door alarm station provided by the owner.
20. Interface to the Aiphone video intercom system.

C. Database Interface

1. OpenDX delivers a seamless, automated interface from any ADO Compliant database including Microsoft's Active Directory into the DNA Fusion™ access control system. Mac integration is preferred.

D. SMS Third-party Devices: The SMS shall interface with select devices from the following manufacturers:

1. Ademco Vista
2. Siemens, Silent Knight fire alarm panel

2.5 CABLING AND CONDUIT

A. Cabling: Provide all cabling required per the manufacturer. Route in Wiremold 700, 2100 when exposed.

B. All exposed cabling shall be routed in Wiremold 700 and 2100 with all required accessories for a complete installation. Review all routing with the owner

C. Mount all access control equipment in the building MDF and IDF rooms. Existing fiber optic cable run between buildings is available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of electronic security system.

B. Examine rough-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before electronic security system installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SYSTEM INTEGRATION

A. Integrate electronic security system with the following systems and equipment:

1. Electronic door hardware.
2. Aiphone Video System

3.3 PROGRAMMING

A. Programming system configuration parameters shall be as directed by the owner. The contractor shall attend a meeting and review the entire system with the owner and program as directed. The programming parameters shall be written by the contractor and approved by the owner or the system is not considered programmed to the owner's needs. After 3 months return to the site and adjust all programming as directed by the owner.

3.4 INSTALLATION

A. Install electronic security system in accordance with manufacturer' written instructions.

B. Wiring Method: Install wiring in metal raceways in exposed areas and above non-accessible ceilings. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4-inch. Control and data transmission wiring shall not share conduit with other building wiring systems. Cable, concealed in accessible ceilings, walls, and floors when possible.

C. Installer shall fully program the existing ADV system at Woodinville High School to accommodate all new devices and cards on this project. Program all cards as directed by the district.

D. Integrate system to the Bosch D9412GV3 security panel. The interior access control card readers shall deactivate the security system and rearm the system.

3.5 TRAINING

A. Provide complete training systems to building users and as well as district maintenance staff. Contractor shall provide 1 training session of 8 hours to building user and 2 sessions of 4 hours each to maintenance personnel. Record all sessions and deliver 3 copies of training sessions to the owner.

3.6 ASBUILT DRAWINGS

A. Provide complete as-built floor plan drawings of all installation indicating equipment installed, labels, and raceway routing. Provide in Autocad, PDF format and 3 hard copies.

3.7 OPERATIONS AND MAINTENANCE MANUAL

A. Provide 3 copies of maintenance manual include parts list, cuts on all equipment with exact type indicated and a separate section with all maintenance information

B. Provide in 3 ring binder with tabs and in PDF form.

END OF SECTION 281300

SECTION 281600 – DETECTION, ACCESS, AND ALARM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide combination intrusion detection control panels, including engineering, components, installation and commissioning.

B. Provide connection to DDC panel to monitor refrigeration status. Coordinate with DDC contractor.

1.2 REFERENCES

A. Reference Standards: Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section:

1. Underwriters Laboratories Inc. (UL):

   a. UL 365: Police Station Connected Burglar Alarm Units and Systems.
   b. UL 609: Local Burglar Alarm Units and Systems.
   c. UL 611: Central Station Burglar-Alarm Units.
   d. UL 636: Holdup Alarm Units and Systems.
   e. UL 684: Local, Central Station, and Remote Station.
   f. UL 1023: Household Burglar-Alarm System Units.
   g. UL 1076: Proprietary Burglar-Alarm Units and Systems.
   h. UL 1610: Central-Station Burglar-Alarm Units.

2. Federal Communications Commission (FCC):

   a. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
   b. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.

1.3 SYSTEM DESCRIPTION

A. Intrusion Detection Control Panels: Basis-of-design is the Honeywell VISTA 128BPT System or Bosch 9412, a burglary switching system that includes the following capabilities:

1. Listed for UL Commercial Burglary.
2. Supports up to 128 zones.
3. Supports up to 8 separate partitions.
4. Supports up to 150 users.
5. Supports commercial wireless devices.
6. Integrate to owner provided access control system
7. Provides supervision of peripheral devices.

8. Supports up to 96 optional relay outputs.
9. Supports long-range radio (LRR) communication.
10. Provides scheduling capability to allow for automated operations.
11. Supports alarm reporting via Internet.
12. Interfaces with automation software.
13. Monitors smoke detector maintenance signals
14. Capable of being installed using existing wiring

1.4 SUBMITTALS

A. Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use, including instruction manuals.

B. Shop Drawings: Submit complete shop drawings including connection diagrams for interfacing equipment, list of connected equipment, and locations for major equipment components.

C. Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings not later than Substantial Completion of the project.

D. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the system installed. Include system and operator manuals.

E. Field Tests: Submit results of field testing of every device including date, testing personnel, retesting date if applicable, and confirmation that every device passed field testing.

F. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a one year period for Owner's review. Maintenance shall include, but not be limited to, labor and materials to repair the system, provide test and adjustments, and regular inspections.

1.5 QUALITY ASSURANCE

A. Manufacturer: Minimum ten years experience in manufacturing and maintaining similar systems. Alarm manufacturer shall be certified compliant with ISO 9001.

B. Installer: Minimum two years experience installing similar systems, and acceptable to the manufacturer.

C. Environmental Conditions: System shall be designed to function in the following environmental conditions:

1. Storage Temperature: Designed for a storage temperature of -10° C to 70°C.
2. Operating Temperature: System shall be designed for an operating temperature of 0° C to 50°C (32° F to 120°F).

3. Humidity: System shall be designed for normal operation in an 85% relative humidity environment.
4. Electromagnetic Interference: System shall meet or exceed the requirements of FCC Part 15, Class B devices, FCC Part 68, IEC EMC directive.

D. Power Requirements: Components shall have the following electrical specifications. The system shall operate using standard 120 VAC, 50 Hz/60 Hz power.

1. Control Primary Power: Transformer power shall be 16.5 VAC, 40 VA.
2. Backup Battery: Rechargeable 12 VDC, gel type, lead acid backup battery shall be provided. The battery shall be rated between 12 and 34-ampere hours (AH).
3. Alarm Power: 12 VDC, 1.7 amps for each bell output
4. Auxiliary Standby Power: 12 VDC, 0.75 amp maximum.
5. Total Power: Combined auxiliary standby and alarm currents shall be 2.3 amps.
6. Fusing: The battery input, auxiliary, and bell outputs shall be protected using PTC circuit breakers. All outputs shall be power limited.

E. Control Panel Enclosure: A metal cabinet, suitable for wall mounting. Dimensions shall not exceed 14.5 inches (36.8 cm) in height, 12.5 inches (31.8 cm) in width or 3 inches (7.6 cm) in depth.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's labeled packages. Store and handle in accordance with manufacturer's requirements, in a facility with environmental conditions within recommended limits.

1.7 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's standard one-year warranty for the system.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Intrusion Detection Alarm Panel Manufacturer: VISTA 128BPT by Honeywell, www.security.honeywell.com. Provide all devices for a complete and fully functional addressable security system.

2.2 SYSTEM PERFORMANCE

A. Control Panel: The control panel shall be an 8-partition, UL commercial and burglary control panel that supports up to 128 zones using basic hardwired, polling loop, and wireless zones, RF receivers, and relay modules. The control shall provide the ability to schedule time-driven events, and allow certain operations to be automated by pressing a single button. The system shall be capable of interfacing with an ECP long

range radio (LRR) unit that can send Contact ID messages. The control shall provide integrated access control and CCTV-switching capability with the use of a single downloader and database.

1. Intrusion Detection System components shall be connected using Honeywell Genesis Series Cables as required for application. Plenum rated:
2. Basic Hardwired Zones: Control shall provide 8 style-B hardwire zones with the following characteristics:

    a. EOLR supervision (optional for zones 2-8) shall support N.O. or N.C. sensors (EOLR supervision required for UL installations).
    b. Zones/Points shall be individually assignable to any partition.

3. Optional Expansion Zones:

    a. Polling Loop Expansion as required

4. Partitions: Control shall provide the ability to operate e8 separate areas, each functioning as if it had its own control. Partitioning features shall include:

    a. A Common Lobby partition (1-8), which can be programmed to perform the following functions:
        1) Arm automatically when the last partition that shares the common lobby is armed.
        2) Disarm when the first partition that shares the common lobby is disarmed.
    b. A Master partition (9), used strictly to assign keypads for the purpose of viewing the status of all 8 partitions at the same time (master keypads).
    c. Assignable by zone.
    d. Assignable by keypad/annunciator.
    e. Assignable by relay to one or all 8 partitions.
    f. Ability to display burglary and panic and/or trouble conditions at all other partitions' keypads (selectable option).

5. Certain system options selectable by partition, such as entry/exit delay and subscriber account number or all partitions. Certain characteristics must be assigned to each user code, as follows:

    a. Authority level (Master, Manager, or several other Operator levels). Each User Code (other than the installer code) shall be capable of being assigned the same or a different level of authority for each partition that it will operate.
    b. Opening/Closing central station reporting option.
    c. Specific partitions that the code can operate.
    d. Global arming capability (ability to arm all partitions the code has access to in one command).
    e. Use of an RF (button) to arm and disarm the system (RF key must first be enrolled into the system).

6. Peripheral Devices: Control shall support up to 30 addressable ECP devices, which can be any combination of keypads, RF receivers, relay modules, and interactive phone module. Peripheral devices have the following characteristics:

   a. Each device set to an individual address according to the device's instructions.
   b. Each device enabled in system programming.
   c. Each device's address shall be supervisable (via a programming option).

7. Keypad/Annunciator: Control shall accommodate up to 16 keypads or six (6) touch- screen (i.e.; advanced user interface) keypads. The keypads shall be capable of the following

   a. Performing all system arming functions.
   b. Being assigned to any partition.
   c. Providing four programmable single-button function keys, which can be used for:
      1) Panic Functions: activated by wired and wireless keypads; reported separately by partition.
      2) Keypad Macros: 32 keypad macro commands per system (each macro is a series of keypad commands). Assignable to the A, B, C, and D keys by partition.

8. Optional Output Relays: A total of 96 relay outputs shall be accommodated using relay modules. Each relay module shall provide four (4) Form C (normally open and normally closed) relays for general-purpose use. The relays shall be capable of being:

   a. Programmed to activate in response to system events.
   b. Programmed to activate using time intervals.
   c. Activated manually.
   d. Assigned an alpha descriptor.
   e. A combination of 4204 (ECP) and 4101SN (polling loop) relays.

9. Vista Interactive Phone Module: The control shall support the ADEMCO 4285/4286 VIP Modules, which permit access to the security system in order to perform the following functions:

   a. Obtain system status information.
   b. Arm and disarm the security system.
   c. Control relays.
   d. Battery saving feature.

10. Integrated Access Control: Control shall be capable of interfacing the Open Options Access Control system.
11. Optional Keyswitch: Control shall support the ADEMCO 4146 Keyswitch on any one of the system's 8 partitions. If used, zone 7 is no longer available as a protection zone.

12. Voltage Triggers: System shall provide voltage triggers, which change state for different conditions. Used with devices such as a remote keypad sounder or keyswitch ARMED and READY LEDs.
13. Event Log: System shall maintain a log of different event types (enabled in programming). The event log shall provide the following characteristics:

    a. Stories up to 512 events.
    b. Viewable at the keypad or through the use of Compass software.
    c. Printable on a serial printer, including zone alpha descriptors.

14. Scheduling: Provides the following scheduling capabilities:

    a. Open/close schedules (for control of arming/disarming and reporting).
    b. Holiday schedules (allows different time windows for open/close schedules).
    c. Timed events (for activation of relays, auto-bypassing and un-bypassing, auto- arming and disarming, etc.).
    d. Access schedules (for limiting system access to users by time).
    e. End User Output Programming Mode (provides 20 timers for relay control).
    f. The system shall automatically adjust for daylight savings time.

15. Communication Features: Supports the following formats and features for the primary and secondary central station receivers:

    a. Formats: ADEMCO Express; ADEMCO Contact ID 4 and 10 Digit Acct
    b. Backup reporting: The system shall support backup reporting via the following: Secondary phone number; ECP long-range radio (LRR) interface; option to select long range radio (LRR) or dialup as the primary reporting method (dynamic signaling feature).
    c. Internet reporting: The system shall be capable of communicating with the central station via the internet using Alarmnet-i. It shall provide the user with the ability to control the system via a browser interface (i.e., AOL, Netscape, Internet Explorer). All packet data transmitted to the monitoring station shall be encrypted with a minimum of 1024 bits of encryption.

16. Audio Alarm Verification Option: Provides a programmable Audio Alarm Verification (AAV) option that can be used in conjunction with an output relay to permit voice dialog between an operator at the central station and a person at the premises.
17. Cross-Zoning Capability: Helps prevent false alarms by preventing a zone from going into alarm unless its cross-zone is also faulted within 5 minutes.

    a. Alarm notification appliances, including but not limited to sirens horns, bells and strobes.
    b. Auxiliary devices capable of operating using full-wave rectified unfiltered voltage.

18. Exit Error False Alarm Prevention Feature: System shall be capable of differentiating between an actual alarm and an alarm caused by leaving an entry/exit door open. If not subsequently disarmed, the control panel shall:

    a. Bypass the faulted E/E zone(s) and/or interior zones and arm the system.
    b. Generate an Exit Error report by user and by zone so the central station knows it was an exit alarm and who caused it.

19. Built-in User's Manual and Descriptor Review: For end-user convenience, the control panel shall contain a built-in User's Manual. It shall include the following capabilities:

    a. By depressing any of the function keys on the keypad for five (5) seconds, a brief explanation of that function shall scroll across the alphanumeric display.
    b. By depressing the READY key for five (5) seconds, all programmed zone descriptors shall be displayed (one at a time). This feature shall provide a check for installers and ensure all descriptors have been entered properly.

20. Programming: Control shall be capable of being programmed locally or remotely using the ADEMCO Compass Downloader and shall be capable of:

    a. Uploading and downloading all programming information at 300 baud.
    b. Uploading and displaying firmware revision levels from the control.

21. Automation Software: The Control shall be capable of interfacing with automation software via an RS232 input on a single partition.

2.3 COMPONENTS

A. System Integration: System shall integrate with facility doors, windows, and departments.

B. The system shall also integrate with external systems, such as building appliances and building alert systems for remote control and central collection of external system alerts. When integrated with external systems, the system shall connect to the external system to receive status changes by way of a dry contact output from the external system. The system shall use its user interface to provide local status messages from external systems, providing for the initiation of local building policies. Optionally, the system may transmit information to an off-site monitoring service to provide initiation of remote policies when appropriate. The installer shall follow manufacture's instructions when installing and programming system equipment.

1. V-Plex Bus Extensions: Extended system V-Plex bus branch circuits shall be scaleable to increase the total size of the bus in larger installations. Branch circuits leading from different buildings or from different floors in multi-story

buildings shall be isolated from one another so that a shorted or grounded branch circuit is isolated away from other near-side branch circuits, allowing other V-Plex devices to be isolated so that they can continue to operate.

2. Zone Input: System zone inputs allow the system to sense the change in state of an output from an external device, such as a door/window position sensor, a motion detector, a relay output from an appliance, the output of an external alert system, or other devices that provide a dry closure output.
3. VSI Bus Isolation and Integrity: System V-Plex bus branch circuits shall be isolated from one another so that a shorted, overloaded, or grounded branch circuit is isolated away from other near-side branch circuits, allowing undamaged V-Plex bus circuits to continue to operate. VSI Isolation modules shall be installed at near-side connections to cable runs leading to additional buildings, at cable runs leading to additional floors in multi-story buildings, and at junction boxes leading to multiple V- Plex branch circuits within the system. The installer shall use the Honeywell VSI module or equivalent.
4. Zone Input: System zone inputs allow the system to sense the change in state of an output from an external device, such as a door/window position sensor, a motion detector, a relay output from an appliance, the output of an external alert system, or other devices that provide a dry closure output.

2.4 DOOR SWITCHES

A. All door switches shall be DPDT for reporting to the security and owner provided access control systems. Provide auxiliary contact.

B. Hollow Steel Frame Doors: Monitor the opened and closed position of doors in the facility. The installer shall install a Honeywell Model 4191SN-WH Recessed 1/2” sensor, equipped with the steel door adapter or equivalent. The installer shall follow manufacturer instructions while installing and programming system equipment.

C. Filled Steel Frame Doors: Monitor the opened and closed position of doors in the facility. The installer shall install a Honeywell Model 960 Door sensor, and a 4193SN or equivalent. The installer shall follow manufacturer instructions while installing and programming system equipment.

D. Wood Frame Doors: Monitor the opened and closed position of doors in the facility. The installer shall install a Honeywell Model 4191SN-WH Recessed ½” sensor or equivalent. The installer shall follow manufacturer instructions while installing and programming system equipment.

2.5 DEVICES

A. Panic Buttons: Include manual panic buttons under desks, in storage rooms, in walk-in refrigeration units and other designated locations. The panic button shall be the Honeywell Model 269SN or equivalent.

B. Dual Tech Motion Detector, Ceiling-Mounted, V-Plex: Selected areas in the protected

site will use motion detectors to sense motion in rooms or areas of rooms. Where designated in the plans, install a Honeywell DT6360STC

C. Dual-Tec Motion Detector, Wall-Mounted, V-Plex: Selected areas in the protected site will use motion detectors to sense motion in rooms or areas of rooms. Where designated in the plans, install a Honeywell Model DT8035 Dual-Tec Motion Detector

D. Glass Break Detector: Flush ceiling mount. Honeywell# FG1625RFM

E. Siren Indoor/Outdoor in Enclosure: Monitor the status of protected openings and areas in the armed and disarmed state. When an audible alarm occurs, the system shall sound a Honeywell Model 719 Siren or equivalent located inside a 742BE Enclosure. The installer shall install the siren as directed by manufacturer instructions. Siren Enclosure Indoor/Outdoor: 719 Sirens shall be enclosed in a 742BE Enclosure. Provide one at main keypad at inside each exterior door.

F. Premium Keypad, Alpha Display: The system keypad shall include a two-line, reverse display alphanumeric LCD display. Use the Honeywell Vista 6460 keypad or equivalent. The installer shall follow manufacturer's installation instructions when installing system equipment.

G. Cabling: As required by the manufacturer

H. Addressable Modules: As required by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine site conditions prior to installation. Notify Architect and Owner in writing if unsuitable conditions are encountered. Do not start installation until site conditions are acceptable.

3.2 INSTALLATION

A. Intrusion detection and fire alarm control panel system shall be installed and tested in accordance with manufacturer's installation instructions.

1. Coordinate interfaces with Owner's representative where appropriate.
2. Provide backboxes, pullboxes, connectors, supports, conduit, cable, and wire for a complete and reliable installation. Obtain Owner's approval for exact location of all boxes, conduit, and wiring runs prior to installation.
3. Install conduit, cable, and wire parallel and square with building lines, including raised floors areas. Do not exceed forty percent fill in conduits. Gather wires and tie to create an orderly installation.
4. Coordinate with other trades to provide proper sequencing of installation.

3.3 FIELD COMMISSIONING AND CERTIFICATION

A. Field Commissioning: Test system as recommended by manufacturer, including the following:

1. Conduct complete inspection and testing of equipment, including verification of operation with connected equipment.
2. Test devices and demonstrate operational features for Owner's representative and authorities having jurisdiction as applicable.
3. Correct deficiencies until satisfactory results are obtained.
4. Submit written copies of test results.

3.4 TRAINING

A. Conduct on-site system training, with the number of sessions and length of sessions as recommended by the manufacturer. Training shall include administration, provisioning, configuration, operation and diagnostics.

END OF SECTION 281600

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SECTION 283111 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Fire

1. Provide all permits, labor, equipment, materials and services to furnish and install a fully tested functional, UL Listed, code compliant, intelligent addressable networked fire alarm, emergency communications and active smoke control system including but not limited to all initiation and notification appliances, all raceways and wiring, connection to a central monitoring station.
2. Connection to the central system is through the Western State Hospital Fire Alarm network. Contractor shall connect to the Edwards UL monitoring network at Building 18. Connection shall be via fiber optic cable and contractor shall provide fiber modules in the new fire alarm panel and in the existing fire alarm panel.
3. The system supplied under this specification shall utilize modular low voltage design with direct wired, node to node, peer-to-peer network communications. The system shall utilize independently addressed, fire detection devices, input/output control modules, audio amplifiers, telephone communications and notification appliances as described in this specification. Network panels shall contain the required user interfaces for all functions. All equipment shall be new and the current products of a single manufacturer, actively engaged in the manufacturing and sale of digital fire detection devices for over ten years.
4. Also included are system wiring, raceways, pull boxes, terminal cabinets, mounting boxes, and any accessories and miscellaneous items required for a code compliant system.
5. The system drawings show the intended of coverage and suggested device locations. Final device quantity, location, and AHJ approval are the responsibility of the contractor.
6. The final system shall be complete, tested, and ready for operation as described elsewhere in this specification, before owner acceptance.
7. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, is compatible with existing systems, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

1.2 RELATED WORK - FIRE

A. The Contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm system shall include, but not be limited to:

1. Sprinkler waterflow and supervisory switches shall be furnished and installed by the fire protection contractor, but wired and connected by the electrical contractor. Modification of existing sprinkler devices to accommodate

monitoring by the new fire alarm system shall be the responsibility of the fire alarm system installing contractor.

2. Duct smoke detectors shall be furnished, wired and connected by the electrical contractor. The HVAC contractor shall furnish necessary duct opening to install the duct smoke detectors.
3. New air handling and smoke exhaust system fan control circuits and status contacts to be furnished by the HVAC control equipment.
4. Elevator recall control circuits to be provided by the elevator control equipment. Modifications to the existing elevator controls to accommodate ANSI A17.1 shunt trip activation shall be provided by the elevator controls contractor. Any shunt trip circuit breakers and related wiring required for ANSI A17.1 compliance shall be provided by the electrical contractor (see power riser for more details).
5. Dry pipe/deluge sprinkler system release valve control circuits and supervision contacts shall be provided by the dry pipe/deluge sprinkler system control equipment.
6. Kitchen hood extinguishing systems status monitoring.
7. IP network interface

    a. Coordinate with the owner's IT department for interconnection between the owner's existing TCP/IP network and the TCP/IP network equipment supplied under this contract.

1.3 CODES-GENERAL

A. All work and materials shall conform to all applicable federal, state and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the engineer for resolution. National standards shall prevail unless local codes are more stringent.

B. The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the engineer.

1.4 FIRE CODE

A. The equipment and installation shall comply with the provisions of the following codes and standards unless the authority having jurisdiction has adopted an earlier version:

1. National Fire Protection Association (NFPA)

    a. NFPA 70 - 2011 National Electric Code®
    b. NFPA 72 - 2010 National Fire Alarm Code®
    c. NFPA 90A - 2012 Installation of Air-Conditioning and Ventilating Systems
    d. NFPA 92A - 2009 Smoke-Control Systems Utilizing Barriers and Pressure Differences
    e. NFPA 92B - 2009 Smoke Management Systems in Malls, Atria, and Large Areas
    f. NFPA 101- 2012 Life Sa*fety Code*®

2. Underwriter's Laboratories, Inc

   a. UL 864 - Control Units for Fire Protective Signaling Systems.
   b. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
   c. UL 268A - Smoke Detectors for Duct Applications.
   d. UL 217 - Single and Multiple Station Smoke Alarms
   e. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
   f. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
   g. UL 464 - Audible Signaling Appliances.
   h. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
   i. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
   j. UL 1971 - Signaling Devices for the Hearing-Impaired.
   k. UL-1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
   l. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
   m. UL 1711 - Amplifiers for Fire Protective Signaling Systems.
   n. UL 1635 - Digital Alarm Communicator System Units
   o. UL-1638 - Signaling Appliances - Private Mode Emergency and General Utility Signaling

3. Factory Mutual (FM) approval
4. International Code Council

   a. International Building Code
   b. International Fire Code
   c. International Mechanical Code

5. Federal Codes and Regulations

   a. Americans with Disabilities Act (ADA)

6. Electrical Industries Association

   a. EIA-232-D: Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
   b. EIA-485: Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems

1.5 DEFINITIONS AND ABBREVIATIONS

A. ACU: Autonomous Control Unit.

B. ADA: Americans with Disabilities Act.

C. AFF: Above Finished Floor.

D. AHJ: Authority Having Jurisdiction.

E. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.

F. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.

G. CCS: Central Control Station.

H. CPU: The central computer of a multiplex fire alarm or voice command control system.

I. ECS: Emergency Communication System.

J. FACP: Fire Alarm Control Panel.

K. FCC: Fire Command Center.

L. FM: FM Global (Factory Mutual)

M. FSCP: Firefighter's Smoke Control Panel.

N. HPSA: High Power Speaker Array.

O. HVAC: Heating Ventilating and Air Conditioning.

P. IDC: Initiating Device Circuit.

Q. LCD: Liquid Crystal Display.

R. LED: Light Emitting Diode.

S. LOC: Local Operating Console.

T. MN: Mass Notification.

U. MNEC: Mass Notification Emergency Communications.

V. NAC: Notification Appliance Circuit.

W. NFPA: National Fire Protection Association.

X. NICET: National Institute for Certification in Engineering Technologies

Y. NRTL: Nationally Recognized Testing Laboratory

Z. PTR: Printer.

AA. RCP: Remote Control Panel

BB. SLC: Signaling Line Circuit.

CC. Style 1: As defined by NFPA 72, Class B.

DD. Style 4: As defined by NFPA 72, Class B.

EE. Style 6: As defined by NFPA 72, Class A.

FF. Style 7: As defined by NFPA 72, Class A.

GG. Style B: As defined in NFPA 72, Class B.

HH. Style D: As defined in NFPA 72, Class A.

II. Style Y: As defined in NFPA 72, Class B.

JJ. UL or ULI: Underwriters Laboratories, Inc.

KK. UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.

LL. Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.6 SYSTEM DESCRIPTION - FIRE

A. The system supplied under this specification shall be a new UL Listed modular fire alarm network that uses independently addressed fire detection devices, input/output control modules, and notification appliances.

B. The network shall consist of a main panel and remote control panels. To enhance survivability, each panel shall be an equal, active functional member of the network, capable of making all local decisions and initiating network tasks for other panels. In the event of a panel failure or communications failure between panels, panels shall be capable of forming sub-networks and remain operational between communicating panels. Master/slave system configurations shall not be considered as equal.

C. The system shall be fully field programmable such that virtually any combination of system output functions may be correlated to any type of input event(s). Inputs may be combined using Boolean logic, be time dependent or under manual control, as defined by required system operation. All software operations are to be stored in a non-volatile programmable memory within the fire alarm control panels. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.

D. Addressable smoke detector sensitivity settings for both pre-alarm and alarm activation shall be automatically individually configurable for both daytime and nighttime operation. Addressable smoke detectors shall be UL listed for automatic sensitivity testing.

E. Ease of maintenance shall be facilitated by the use of panel based and PC based system diagnostics.

1. The system shall automatically test smoke detector sensitivity, eliminating the need for manual sensitivity testing.

2. Ground fault detection and annunciation shall be by individual module address for supervised input and output devices.
3. System test operation shall be configurable by individual addressable devices, and not disable entire circuits.
4. The system shall be capable of generating a graphical map of connected all addressable devices to aide in circuit troubleshooting.
5. Placement supervision of addressable devices shall couple a device's location (not its address) to the programmed system response.

F. The system shall be designed, inspected, tested and approved to provide occupant notification audibility levels of 15 dBA over ambient conditions.

G. The system shall interface with other building systems as required by the fire codes.

H. The system shall transmit required signals to a central monitoring station via Building 18.

I. System panels and annunciators shall utilize configurable message routing and selective event messaging to direct event information only to the required system displays and printers as determined by the event type and location.

1.7 FIRE ALARM PERFORMANCE

A. Comply with the provisions of NFPA 72 and the operational requirements of this specification.

B. The system shall identify all off normal conditions and log each condition into the system as an event.

1. The system shall automatically display on the control panel Liquid Crystal Display (LCD) the first (oldest) event of the highest priority by type. The event priority shall be alarm, supervisory, trouble, and monitor.
2. The system shall utilize four event queues, and shall not require event acknowledgment by the system operator. Labeled, color coded indicators shall be provided for each type of event queue: alarm - red, supervisory - yellow, trouble - yellow, monitor - yellow. When an unseen event exists for a given type, the indicator shall be lit.
3. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred and up to a 42 character custom user description.
4. The user shall be able to review each event queue by simply selecting scrolling keys (up-down) for the event type.
5. New alarm, supervisory, or trouble events shall sound a distinct, silenceable audible signal at the control panel.
6. The LCD shall show the number of active alarm, supervisory, trouble and monitor events
7. The LCD shall show the system time and the number of active and disabled points in the system.
8. Specific input/output devices shall operate in accordance with the alarm, supervisory, trouble, monitor sections that follow and the input/output matrix.

C. All critical systems, sub-systems and circuits shall be monitored for integrity. System faults shall be annunciated.

D. Strobes shall be synchronized on each floor.

E. Batteries shall be sized to support the system for 24 Hrs. of standby operation followed by 15 minutes of alarm operation at the end of the 24 Hour period or as required by the Fire Marshal.

F. Off premises reporting of the loss of AC mains power to any system component shall be automatically delayed for a period of time acceptable to the AHJ to reduce traffic at the central monitoring station due to wide-area power failures.

G. The system shall provide configurable service groups to facilitate “one man” testing of the system based on the physical layout of the building. Each service group shall be capable of supporting any combination of system devices, independent of the circuit on which they are installed. Systems that disable entire circuits, circuits serving multiple floors or fire zones for testing shall not be considered as equal. Activated devices on a service group shall be capable of initiating alternative system test responses to facilitate system maintenance and minimizing occupant disturbances while in test mode.

H. Event processing and display shall be prioritized as follows:

1. Fire alarms
2. Supervisory events
3. Trouble events
4. Monitor events

1.8 ALARM OPERATION

A. Upon the alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, duct smoke detector, the following functions shall automatically occur:

1. The system shall remain in the alarm mode until all initiating devices are reset and the fire alarm panel is manually reset and restored to normal.
2. The internal audible device shall sound at the control panel or command center.
3. Display the alarm event on the graphical workstation.
4. The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.
5. All system activity/events shall be documented on the system printer and logged into system history.
6. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

B. Sound the ANSI 117-1 signal with synchronized audibles and synchronized strobes throughout the facility.

C. Audible alarm signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

D. The notification appliance dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

E. Transmit signal to the building automation system.

F. Transmit signal to the central monitoring station with point identification.

G. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

H. Activation of elevator lobby or elevator equipment room smoke detectors shall initiate recall of the bank of elevators to the 1st floor and lockout the elevator controls. Activation of the first floor elevator lobby smoke detector shall recall shall be to an alternate floor, and lockout the elevator controls.

I. Activation of heat detectors in elevator shafts and machine rooms shall activate the elevator power shunt trip circuit breaker.

J. All stairwell/exit doors shall unlock throughout the building.

K. All self-closing fire/smoke doors held open shall be released.

L. Transmit alarm text messages to "alpha-numerical" display pagers.

1.9 SUPERVISORY OPERATION

A. Upon supervisory activation of any sprinkler valve supervisory switch, clean agent fire suppression system trouble, elevator shunt trip supervision, the following functions shall automatically occur:

B. The internal supervisory event audible device shall sound at the control panel.

C. Display the event on the graphical workstation and display a pictorial image.

D. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.

E. All system activity/events shall be documented on the system printer and logged to system history.

F. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.

G. Transmit signal to the central monitoring station with point identification.

1.10 TROUBLE OPERATION

A. Upon activation of a trouble condition or signal from any device or internal system integrity monitoring function on the system, the following functions shall automatically occur:

1. The internal panel audible device shall sound at the control panel.

2. Display the event on the graphical workstation and display a pictorial image.
3. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
4. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not prevent the logging of trouble events to the historical file.
5. All system activity/events shall be documented on the system printer and logged to system history.
6. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
7. Transmit a trouble signal to the central monitoring station with point identification.

1.11 MONITOR OPERATION

A. Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

1. The internal panel audible device shall sound at the control panel.
2. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
3. Any remote or local annunciator LCD/LED's associated with the monitor circuit shall be illuminated.

1.12 QUALITY ASSURANCE

A. The system supplier shall have a minimum of 10 years of experience in distribution and service of the proposed equipment brand.

B. The supplier shall have successfully designed and installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable scope, size and complexity.

C. The supplier shall have in-house engineering and project management capability consistent with the requirements of this project. The project shall be supervised by personnel certified by NICET as fire alarm Level IV technicians.

D. The supplier shall employ qualified and manufacturer certified system designers to perform the detailed engineering design, system calculations, for all the system equipment and programming.

E. The supplier shall produce all panel and equipment drawings, submittals, and operating manuals, as detailed elsewhere in this specification.

F. The supplier shall be responsible for providing qualified on site representative(s) for coordination of system installation, and final system testing and commissioning in accordance with these specifications.

G. Qualifications of Installer

1. Before commencing work, submit evidence showing that the equipment installer has successfully installed systems of the similar scope, type and design as specified.
2. The contractor/installer shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
3. The contractor/installer shall be responsible for retaining qualified and authorized representative(s) of the system manufacturer (The Supplier) specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.
4. The contractor/installer shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.
5. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

1.13 SUBMITTAL GENERAL

A. The contractor shall not purchase any equipment for the specified system until the owner has approved the project submittals in their entirety and has returned them to the contractor.

B. Approved submittals allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications.

C. Each submittal shall include a detailed list of variations that the submittal may have from the requirements of the contract documents.

D. The contractor shall provide specific notation on each shop drawing, sample, data sheet, installation manual, etc. submitted for review and approval, of each variation.

E. Any conflicts in the contract documents and/or with Authority Having Jurisdiction (AHJ) requirements shall be submitted to the owner in writing 7 days prior to bid.

F. Submittals shall be approved by authorities having jurisdiction prior to submitting them to the Architect.

1.14 SUBMITTAL BOOKS

A. Submit for approval no less than three (3) copies of a submittal book to the consulting engineer for review and comment.

B. Submittal books shall meet the following requirements:

1. Shall be a 3-ring binder with a cover that shows the project address, system type, and contractor.
2. Shall use labeled dividers for major sections.
3. Shall include:

    a. Cover sheet

b. Table of contents
   1) Provide a list of all types of equipment and components provided. This shall be incorporated as part of a table of contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
c. Product data sheets, as detailed elsewhere in this specification
d. Provide description of operation of the system (sequence of operation), similar to that provided in Part 2 of this section of the specifications. The description shall be specific to this project, and shall provide individual sequences for every type of alarm, supervisory, or trouble condition, which may occur as part of normal or off-normal system use.
e. B-size (black line) reduced shop drawings, as detailed elsewhere in this specification.
f. System calculations, as detailed elsewhere in this specification.
g. Installation instructions.
h. Provide samples of various items when requested.
i. Copies of all licenses, documents and certifications, as detailed elsewhere in this specification.

C. Additional copies may be required at no additional cost to the project.

1.15 PRODUCT DATA

A. System components proposed in this specification shall be UL listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment.

B. For each product submitted provide the following information:

1. Manufacturer's catalog data, to include material description, agency approvals, operating characteristics, electrical characteristics, dimensions, mounting requirements and accessories.
2. Product data sheets for system components shall be highlighted to indicate the specific products, features, or functions required to meet this specification.
3. Alternate or as-equal products submitted under this contract shall provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
4. Manufacturer's product installation sheets: A copy of the documentation that is required to be shipped with all listed products by UL.

1.16 BATTERY CAPACITY

A. Provide battery capacity calculations for each power supply that uses batteries for secondary power. Identify all loads. Identify any loads shed during alarm operation. Use the manufacturer's recommended methods and/or forms.

B. 24 VDC Notification Appliance Circuits

1. For each 24VDC NAC, provide worst case voltage drop calculations. The load shall be treated as a lump sum at the end of the circuit. *Worst case power supply*

terminal voltage shall include all applicable internal power supply losses. Using 85% of nominal circuit voltage (20.4VDC) shall not be accepted as lowest terminal voltage without manufacturer's published documentation stating there are no internal losses in the power supply.

2. The system shall be designed for interior building audibility level of 15 dBA-fast over ambient condition or as required by the Fire Marshal

C. Fiber Optic Circuits

1. Provide optical fiber loss (budget) calculations per segment of optical fiber. Fiber loss per segment shall not exceed 80% of equipment manufacturer's permitted loss.

1.17 SHOP DRAWINGS

A. Submit for approval three (3) sets of shop drawings to the consulting engineer for review and comment. Drawings shall be either D-size or E-size blue line drawings and of a sufficient resolution to be completely read. Drawing sets shall be bound. Additional copies may be required at no additional cost to the project.

B. Contained in the title block of each drawing shall be symbol legends with device counts, wire tag legends, circuit schedules for all addressable and notification appliance circuits, the project name/address, and a drawing description which corresponds to that indicated in the drawing index on the coversheet drawing. A section of each drawing title block shall be reserved for revision numbers and notes.

C. Shop drawings shall meet the following requirements:

1. Shop drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by the manufacturer of the submitted equipment in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level II minimum

2. Coversheet with project name, address and drawing index.
3. General notes drawing with peripheral device backbox size information, part numbers, device mounting height information, and the names, addresses, point of contact, and telephone numbers of all contract project team members.
4. Provide device floor plans for all areas served by the fire alarm system. <Utilize the CAD Files provided by the consulting engineer in the preparation of the floor plans.> Floor plans shall indicate accurate locations for all control and peripheral devices. Drawings shall be NO LESS THAN 1/8-INCH SCALE. If individual floors need to be segmented to accommodate the 1/8" scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner.

a. All addressable devices shall be shown. Coordinate the device address with the same device shown on the riser diagram.
b. Identify all notification appliances with a circuit and item number. Coordinate the circuit and item number with the same device shown on the riser diagram.

c. Show all raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.

d. Areas required to meet intelligibility requirements shall be clearly identified. Wide area mass notification system plot drawings shall identify all project areas that must meet intelligibility requirements as well as environmentally sensitive areas on or off of the project site where system output shall be minimized.

5. Device riser diagram, which individually depict all control panels, annunciators, addressable devices, and notification appliances. Shall include a specific, proposed device description above each addressable device. Shall include a specific, discrete device address that corresponds to addresses shown on the floor plans. Drawings shall provide wire specifications, and wire identification for all conductors depicted on the riser diagram. All circuits shall have identifiers that shall correspond with those required on the control panel and floor plan drawings. End-of-line resistors (and values) shall be depicted.
6. Control panel drawing(s) shall show internal component placement and all internal and field terminations. Provide details indicating where conduit connections shall be made to avoid conflicts with internally mounted batteries. For each additional fire alarm panel, a separate drawing which clearly indicated the panel designation, service and location of the control enclosure.
7. Provide typical device wiring diagrams that show all system components, and the respective field wiring. Wire type, gauge, and jacket shall be indicated. When an addressable module is used in multiple configurations for monitoring or controlling equipment, provide a drawing for each application. End-of-line resistors (and values) shall be shown.
8. Provide a fire alarm system function matrix that illustrates alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions.
9. System Calculations as detailed elsewhere in this specification.

D. Upon receipt of approved drawings from the Authority Having Jurisdiction, the supplier shall immediately forward two sets of drawings to the owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

1.18 CLOSEOUT

A. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance.

1. Project specific operating and maintenance manuals covering the system as installed. The manuals shall contain a description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. A generic instruction and operation manual shall not be acceptable.
2. Technical literature (manufacturer's data sheets and installation manuals/instructions) for all parts of the system, including control panels, smoke detectors, batteries, manual stations, alarm notification appliances, power supplies, and remote alarm transmission means.

B. Software and Firmware Operational Documentation:

1. THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SITE-SPECIFIC SOFTWARE RUNNING IN THE SYSTEM. The fire alarm equipment supplier shall provide hard and soft copies of the software database to the end-user at the end of the warranty period. The database provided shall be useable by any authorized and certified distributor of the product line, and shall include all applicable passwords necessary for total and unrestricted use and modification of the database.

C. Drawings

1. Provide "As Built" drawings of record of all the shop drawings used in the installation of the system.
2. Refer to the Submittals - Shop Drawings section of this specification for drawing requirements.

D. Record of Completion

1. System supplier and contractor shall provide a certified test report to verify that the system and all components functioned properly and as intended.
2. A filled out Record of Completion similar to NFPA 72, 2007 edition figure 4.5.2.1 shall be provided.

E. Warranty

1. Provide copies of the warranty documentation as detailed in the Warranty section of this specification.

F. Service Organization

1. Provide the name, address and telephone of the authorized factory representative.

G. Training

1. Conduct the required training as detailed in the Startup and Commissioning - Training section of this specification.

1.19 DELIVERY AND STORAGE

A. Receiving

1. The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.
2. Overnight storage of materials is limited to the assigned storage area. Materials brought to the work area shall be installed the same day, or returned to the assigned storage area unless previously approved by the Owner.
3. The Contractor shall remove rubbish and debris resulting from his work on a daily basis. Rubbish not removed by the Contractor will be removed by the Owner and back-charged to the Contractor.

1.20 RESPONSIBILITY

A. It shall be the contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed.

B. A pre-bid meeting will be held to familiarize the contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.

1.21 WARRANTY

A. The contractor shall warranty the installation and workmanship for one (1) year and all parts for thirty-six (36) months from date of final acceptance. A copy of the manufacturer’s warranty shall be provided with closeout documentation and included with the operation and installation manuals. The full cost of maintenance, labor and materials required to correct any defect during the warranty period shall be included in the submittal bid.

B. During the warranty period, each year the contractor shall perform detector sensitivity testing and provide a report to the owner. If the system is UL Listed to perform automatic detector sensitivity testing without manual intervention, and if a detector falls outside of sensitivity window the system automatically indicates a devices trouble, then this requirement shall be waived. Documentation from UL shall be provided as proof of automatic sensitivity testing operation.

C. The system supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Provide a telephone response to owner’s questions within 4 hours and on-site assistance within 24 hours.

D. Permit the owner’s fire alarm technicians to perform temporary bypasses and emergency repairs on the system without voiding the warranty.

1.22 TEST AND INSPECTION - FIRE

A. Testing, general

1. In addition to tests required in this section, the contractor shall perform all electrical and mechanical tests required by the equipment manufacturer, the architect and the authority having jurisdiction.
2. The contractor shall perform all testing in occupied facilities at times of day that present the lowest impact and disruption to business and activities. Coordinate all testing in occupied buildings with the building owner’s representative to assure that fire alarm system testing does not interrupt operations. This may require extensive after hours work to perform such testing.>
3. All equipment, instruments, tools and labor required to conduct the system tests shall be provided by the installing contractor. At a minimum, the following equipment shall be made available testing:

    a. Ladders and scaffolds as required to reach all installed equipment.
    b. Meters for reading voltage, current and resistance.

c. Two-way communication devices
d. Simulated smoke, heat-producing devices for heat detectors, extension poles for introducing smoke into detectors, as needed.
e. Manufacturer's instruments to measure air flow through duct smoke detectors.
f. Decibel meter.
g. Status and diagnostic software and PC.

B. All testing shall utilize a written acceptance test plan for testing the system components and operation in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the acceptance test plan, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and system programming.

1. The systems operation matrix created by the equipment supplier shall be used to identify each alarm input and verify all associated output functions.

C. The system test plan shall include but not be limited to the following:

1. Visually inspect all wiring.
2. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final acceptance test.
3. System wiring shall be tested to demonstrate correct system response for the following conditions:

a. Open, shorted and grounded signal line circuits.
b. Open, shorted and grounded notification appliance circuits.

D. System indications shall be demonstrated as follows:

1. Correct message content for each alarm input at all system displays.
2. Correct annunciator light for each alarm input at each graphic display.
3. Correct history logging for all system activity.
4. Correct sensitivity for all smoke detection devices. The use of system generated sensitivity reports is acceptable in meeting this requirement.

a. Correct signals sent to the Central Monitoring Station.

5. Notification appliances shall be demonstrated as follows:

a. All alarm notification appliances actuate as programmed
b. Audibility and visibility at required levels. Measure sound levels at 5 ft. above finished floor with the room doors closed.
c. For 24VDC NACS, measure and record the voltage at the most remote appliance on each notification appliance circuit, while operating.

6. System control functions shall be demonstrated as follows:

a. In accordance with the system operation matrix.

7. System off premises reporting functions shall be demonstrated as follows:

   a. Correct information received for each alarm and trouble event

8. Secondary power supply (battery) capacity capabilities shall be demonstrated as follows:

   a. System battery voltages and charging currents shall be measured and recorded at the fire alarm control panels.
   b. System primary power shall be disconnected for <24 hours>. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of <5 minutes>.
   c. System primary power shall be restored for forty-eight (48) hours.
   d. System battery voltages and charging currents shall again be measured and recorded at the fire alarm control panels.

9. Verify the "As Built" record drawings are accurate.

E. Preliminary Testing

1. Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of the written test plan. Correct any deficiencies, omissions or anomalies and retest the affected devices to assure proper function per the specification.

F. Acceptance Testing

1. A final acceptance test shall not be scheduled until the system manuals are provided to and approved by the owner and the following are provided at the job site:

   a. (1) "As Built" record drawings of the system as actually installed
   b. (2) A copy of the system operation matrix.

2. The acceptance inspector shall use the system "As Built" record drawings in combination with the system operation matrix and the written acceptance test plan during the testing to verify system operation.
3. Should the system not perform to the above criteria it shall not be accepted and the contractor shall correct all deficiencies and shall re-test the system at contractor's expense in the presence of the architect using the same test criteria.
4. The building owner's representative shall witness the final tests.
5. The central monitoring station and/or fire department shall be notified before final test in accordance with local requirements.
6. Operate every installed device to verify proper operation and correct annunciation at control panel.
7. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

G. Test Reports

1. A "Fire Alarm System Record of Completion" per the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in shall be prepared by the Contractor. Submit three (3) copies to the Architect. The report shall include, but not be limited to:

   a. A list of all equipment installed and wired.
   b. Certification that all equipment is properly installed and functions and conforms with these specifications.
   c. Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
   d. Technician's name, certificate number and date.

1.23 TRAINING

A. The system supplier shall schedule and present a minimum of eight (8) hours of formal site specific instruction for the building owner, detailing the proper operation and maintenance of the installed system.

B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

D. Copies of all training aids, presentations, etc. shall be left with the owner.

1.24 SPARE PARTS

A. The contractor shall furnish the following extra material that matches the products installed. Spares shall be packaged with protective covering for storage and identified with labels describing contents.

B. Automatic detection devices – 3 smoke detectors, 1 heat detector.

C. Manual fire alarm stations - Two

D. Audible and visible devices – 5

E. Visible only device - 2

F. Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of the products specified in this document. These processes

shall be monitored under a quality assurance program that meets ISO 9000/9001 requirements.

B. The catalog numbers used are those of EDWARDS, a UTC Company or equal, and constitute the type and quality of equipment to be furnished. For a list of EDWARDS authorized fire alarm vendors, contact: edwardsmarketing@fs.utc.com.

C. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall, at the time of bid, list all exceptions taken to these specifications, all variances from these Specifications and all substitutions of operating capabilities or equipment called for in these specifications and forward said list to the engineer. Any such exceptions, variances or substitutions not listed at the time of bid and are subsequently identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination of compliance with these specifications shall rest with the engineer, who, at his discretion, may require proof of performance.

D. Alternate product submissions shall provide proof of no less than three (3) factory authorized and certified manufacturer's distributors within <50 miles> of the project job site. These distributors shall provide installation support, shall have a service organization capable of 24 hour emergency call service and SHALL HAVE BEEN CONTRACTED AND DELIVERED NO LESS THAN FIVE (5) SIMILIAR PROJECTS USING THE SUBMITTED PRODUCT OVER THE PAST YEAR. Alternate submissions without the required references shall be rejected.

E. Alternate product submissions based upon use of a product line considered proprietary in its distribution, design, application software, or ongoing maintenance and repair shall not acceptable. Proof of a product's non-proprietary nature shall be the burden of the contractor at the time of bid, and shall be in the form of written documentation. The determination of a product's compliance to this requirement shall be exclusively that of the engineer.

F. All products used shall be of a single manufacturer. All products shall be listed by the manufacturer for their intended purpose. Submission of notification appliances, auxiliary relays, or documentation from other than a single manufacturer shall not be acceptable and will be grounds for immediate disapproval without comment.

G. Approved Products: All panels and peripheral devices shall be of the standard product of single manufacturer and shall display the manufacturer's name of each component. The catalog numbers specified under this section are those of EDWARDS, a UTC Company, and shall constitute the type, product quality, material and desired operating features.

2.2 FIRE ALARM PANEL

A. Overview

1. All materials, equipment, accessories, devices and other facilities and appurtenances covered by these specifications or noted on the drawings shall be new, best suited for the intended use and shall conform to applicable and recognized standards for their use, and supplied by a single manufacturer. Should any equipment provided under this specification be supplied by a different

manufacturer, that equipment shall be recognized compatible by BOTH manufacturers and listed as such as required by Underwriters' Laboratories.

2. The fire alarm control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control, <extinguishing agent releasing system>, and guard patrol applications. The control panel shall be listed and approved for the application standard(s) as listed in the References section of this specification.
3. The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any applications can be configured, and modified using software provided by the manufacturer. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.
4. The operating controls shall be located in a dead-front steel enclosure behind a locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified. All panel modules shall be placement supervised for and signal a trouble if damaged or removed.

B. System Features

1. Each control panel shall include the following capabilities:

   a. Supervision of the system electronics, wiring, detection devices and software
   b. Up to 2500 analog/addressable input/output points
   c. Network connections with up to 63 other control panels and annunciators.
   d. Support multiple dialers (DACTs) and modems
   e. Two communication ports
   f. An internal audible signal with different patterns to distinguish between alarm, supervisory, trouble and monitor events
   g. Support multiple 24 VDC and Audio NACs
   h. User configurable switches and LED indicators to support auxiliary functions
   i. Log up to 1740 chronological events
   j. The ability to download all applications and firmware from the configuration computer at a single location on the fire network
   k. A real-time clock for time stamps and timed event control
   l. Electronic addressing of intelligent addressable devices
   m. Provide an independent hardware watchdog to supervise software and CPU operation
   n. "Dry" alarm, trouble and supervisory relay contacts
   o. Control panel modules shall plug in to a chassis assembly for ease of maintenance
   p. Field wiring shall connect to the panel using removable connectors

C. User Oriented Features

1. Each control panel shall include the following user oriented features:

a. An LCD user interface control/display that shall annunciate and control system functions.
b. Provide discreet system control switches for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details.
c. A "lamp test" feature shall verify operation of all visual indicators on the panel.
d. An authorized user shall have the ability to operate or modify system functions including system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
e. An authorized user shall have the ability to disable/enable devices, zones, actions, timers and sequences.
f. An authorized user shall have the ability to activate/restore outputs, actions, sequences, and simulate detector smoke levels.
g. An authorized user shall have the ability to enter time and date, reconfigure an external port for download programming, initiate programming and change passwords.
h. An authorized user shall have the ability to test the functions of the installed system.
i. Service groups shall facilitate one-man walk testing. Service/test groups shall be capable of being configured with any combination of addressable devices, independent of SLC wiring. It shall be possible to program alternate device responses when the device's service group is active. Devices not in an active service group shall process all events normally.
j. Provide internal system diagnostics and maintenance user interface controls to display/report the power, communication, and general status of specific panel components, detectors, and modules.
k. SLC loop controller diagnostics shall identify common alarm, trouble, ground fault, Class A fault, and map faults. Map faults include wire changes, device type changes by location, device additions/deletions and conventional open, short, and ground conditions. Ground faults on the supervised circuit wiring of remote addressable modules shall be identified by device address.
l. An authorized user shall have the ability to generate a report history for alarm, supervisory, monitor, trouble, smoke verification, watchdog, and restore activity.
m. System reports shall provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
n. An authorized user shall have the ability to display/report the condition of addressable analog detectors. Reports shall include device address, device type, percent obscuration, and maintenance indication. The maintenance indication shall provide the user with a measure of contamination of a device upon which cleaning decisions can be made.

D. Programmability

1. A Windows-based Configuration Utility (CU) shall be used to create the site-specific system programming. The utility shall facilitate programming of any input point to any output point. The utility shall allow customization of

fundamental system operations using initiating events to start actions, timers, sequences and logical algorithms.

a. Zoning of initiation devices.
b. Initiation of events by time of day, day of week, day of year.
c. Initiation of events by matrix groups (X-Y coordinate relationships) for releasing systems.
d. Initiation of events using OR, AND, NOT and counting functions.
e. Prioritizing system events.
f. Programmable activation of detector sounder bases by detector, groups of bases, or all bases.
g. Directing selected device messages to specific panel annunciators
h. Detector sensitivity selection by time of day
i. Support of 256 Central Monitoring Station accounts and directing selected device messages to any one of ten Central Monitoring Stations.

2. The configuration utility shall time and date stamp all changes to the site-specific program, and shall facilitate program versioning and shall store all previous program version data. The utility shall provide a compare feature to identify the differences between different versions of the site-specific program.
3. The configuration utility shall be capable of generating reports which detail the configurations of all fire alarm panels, addressable devices and their configuration settings including generating electrical maps of the addressable device SLCs.
4. The configuration utility shall support the use of bar code readers to expedite electronic addressing and custom programming functions.
5. Please refer to the *General, System Description Section* for this project's site-specific system operating requirements.
6. The fire alarm control panel shall be an EDWARDS 3-CPU3 and support components in an appropriately sized enclosure.

2.3 Power Supply

A. System power supply(s) shall be a high efficiency switched mode design providing multiple supervised power limited 24 VDC output circuits as required by the panel and external loads fed by the panel. Initial power supply loading shall not exceed 80% of power supply capacity in order to allow for future system expansion.

B. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

C. It shall be possible to parallel system power supplies to increase capacity or to provide redundant operation.

D. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functionality.

E. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

F. All standby batteries shall be continuously monitored by the power supply. The power supply shall be able to perform an automatic load test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range. Power supplies shall incorporate the ability to adjust the charge rate of batteries based on ambient temperatures. The power supply shall automatically disconnect the battery before low voltage damages the battery. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply(s) affected.

G. Batteries shall utilize sealed lead acid chemistry. Initial battery capacity shall provide 125% of calculated capacity requirements in order to allow for future system expansion.

H. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 70 and NFPA 72. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

I. The power supply shall be an EDWARDS 3-PPS/M series.

2.4 PANEL LCD AND COMMON CONTROLS

A. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the facility.

B. Each fire alarm control panel (system node) shall be capable of supporting a backlit LCD display. The display on each system node shall be configurable to *display* the status of any and/or all combinations of all alarm, supervisory, trouble, monitor, or service group event messages on the network. Each LCD display on the system shall be capable of being programmed to allow *control* functions of any combination of nodes on the entire network. The system shall support both 168 character and 960 character LCD displays on the same network.

C. The LCD display shall provide separate alarm, trouble, supervisory, and monitor event queues of to minimize operator confusion. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.

D. The LCD display shall contain the following system status indicators:

1. System Power Indicator
2. System Test Indicator
3. System CPU Fail Indicator
4. Ground Fault Indicator
5. Disabled Points Indicator
6. System Normal Indicator
7. System Common Alarm Indicator
8. System Common Trouble Indicator
9. System Common Supervisory Indicator
10. System Common Monitor Event Indicator

E. The LCD display shall contain the following system switch/indicators:

1. System Reset Switch with Indicator
2. System Alarm Silence Switch with Indicator
3. System Panel Silence Switch with Indicator
4. Drill Switch with Indicator
5. Alarm Acknowledge Switch with Indicator
6. Trouble Acknowledge Switch with Indicator
7. Supervisory Acknowledge Switch with Indicator
8. Monitor Acknowledge Switch with Indicator

F. The LCD display shall contain the following system function switches

1. System Event Message Queue Scroll Switch.
2. Event Details Switch (provides an additional 2000 character message about the device highlighted by the operator.)
3. Command Menu Switch
4. 10-Digit Keypad with Enter and Backspace switches

G. 960 Character Backlit Liquid Crystal Text Display>

1. The user interface shall provide a backlit LCD that will allow custom event messages of up to 42 characters. The interface shall provide a minimum of 24 lines by 40 characters and provide the emergency user hands free viewing of the first seven (7) and last highest priority events. The last highest priority event shall always display and update automatically. Events shall be automatically placed in one of four easy to access queues. It shall be possible to view specific alarm, trouble, supervisory and monitor events separately. Having to scroll through a mixed list of event types shall not be considered as equal. The total number of active events by type shall be displayed. Visual indication shall be provided of any event type that has not been acknowledged or viewed. It shall be possible to customize the designation of all user interface LEDs and Switches for local language requirements.
2. Instructional text messages support a maximum of 2,000 characters each.
3. The system 960 character LCD display shall be a EDWARDS model 3-LCDXL1

2.5 LEDS AND SWITCHES

A. A modular series of switches and LED indicators shall be available to customize the fire alarm control panel operation in accordance with this specification. All LED and switch functions shall be software programmable. Switches shall be configurable for momentary, maintained, toggle, or “exclusive or” operation as required by the application. LEDs shall be configurable for slow flash, fast flash or steady operation. LED/Switch modules shall be capable of mounting in any available fire panel module position. All LED/Switch modules shall be supervised. LEDs shall be available in a variety of colors to facilitate identification from a distance. The LED/Switch modules shall provide ample room for custom function text labels under a protective membrane.

B. The LED/Switch modules shall be EDWARDS 3-24x series, 3-12xx series, and 3-6/3S1xxx series devices.

2.6 REPORTS

A. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

B. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 80% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

C. When addressable CO detectors are installed, performing a “sensitivity” check from the panel shall report the approximate number months of sensor life remaining.

D. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.

E. The system shall provide a report that gives a chronological listing of at least the last 1000 system events.

F. The system shall provide a listing of all of the firmware revision listings for all of the installed components in the system.

2.7 SIGNALING LINE CIRCUITS - FIRE NETWORK WIRING

A. The network inter panel wiring shall be Class A. The network media shall be copper except where fiber optic cable is specified on the drawings.

B. The system supplied under this specification shall utilize node to node, direct wired peer-to-peer network operations. The system shall utilize independently addressed, smoke detectors, heat detectors and input/output modules <intrusion detection> as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes.

C. When a network is wired in a Class B configuration, a single break or short on the network wiring isolates the system into two groups of panels. Each group continues to function as a peer-to-peer network working with their combined databases. When wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

D. The copper network interface shall be an EDWARDS 3-RS485 series.

E. The fiber optic network interface shall be an EDWARDS 3-FIBMB2 with fiber optic transceivers.

2.8 EST3 SYSTEM

A. The signaling line circuit connecting panels/nodes to intelligent addressable devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class A (style 6 or 7). All signaling line circuits shall be supervised and power limited.

B. When the addressable devices on a signaling line circuit cover more than one designated fire/smoke compartment, a wire-to-wire short on the circuit shall not affect the operation of the addressable devices in other fire/smoke compartments.

C. Each SLC shall support 125 addressable detector addresses and 125 module addresses. The SLC shall support 100% of all addressable devices in alarm and provide support for a 100% compliment of detector isolator bases. Initial circuit loading shall not exceed 80% in order to allow for future system expansion.

D. T-taps (branching) shall not be permitted

E. The addressable device SLC module shall be UL Listed for use with code compliant, electrically sound existing wiring.

F. Each intelligent addressable device shall transmit information about its location with respect to other devices on the circuit. This information shall be used to create an “As-Built” wiring diagram as well as provide enhanced supervision of a device’s physical location. The device message and programmed system output function shall be associated with the device’s location on the SLC circuit location and not a device address.

G. The SLC module shall allow replacement of “same type” devices without the need to address and reload the “location” parameters on replacement device.

H. The SLC/Panels shall notify the user when programmed devices are detected on the SLC circuit. The SLC/Panels shall notify the user when the wrong device type is installed at a location configured for a different device type on the SLC circuit.

I. Should an SLC Controller CPU fail to communicate, the SLC circuit shall go into the stand-alone mode. The circuit shall be capable of producing a loop alarm if an alarm type device becomes active during stand-alone mode to enhance system integrity.

J. The addressable device signaling line circuit module shall be an EDWARDS 3-SDDC1 series.

2.9 NOTIFICATION APPLIANCE CIRCUITS

A. General

1. All notification circuits shall be supervised and power limited. Non-power limited circuits are not acceptable. All notification appliance circuits shall be Class A (Style "Z").
2. Initial circuit loading shall not exceed 80% in order to allow for future system expansion.

B. 24 VDC Notification Appliance circuits

1. Notification appliance circuits shall have a minimum circuit output rating of 2 amps @ 24 VDC
2. 24VDC NACs shall be polarized and provide both strobe synchronization and a horn silence signals on a single pair of wires.

2.10 INITIATING DEVICE CIRCUITS

A. Initiating device circuits shall be configurable for latched or non-latched operation and configurable to initiate alarm, supervisory or monitor events.

B. End-of-line resistors for conventional initiating device circuits shall be covered with insulated tubing, terminated with ring lugs and display a UL label.

2.11 DACT

A. The system shall provide off premises communications capability using a Digital Alarm Communications Transmitter (DACT) for sending system events to multiple Central Monitoring Station (CMS) receivers over conventional telephone lines.

B. The system shall provide the CMS(s) with point identification of system events using 4/2, Contact ID ID (SIA DC-05) or SIA DCS protocols. <The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system provided by the owner, using TAP Pager protocol and an internal V.32BIS or greater 14.4Kbaud modem.>

C. The dialer shall support up to 255 individual accounts and to send account information to eight (8) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system design.

D. In the event of a fire alarm panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

E. The owner shall arrange for two (2) dedicated loop-start phone lines to be terminated using two RJ31X jacks within 5 ft of the main fire alarm control panel.

F. The DACT shall be an EDWARDS 3-MODCOM(P).

2.12 REMOTE BOOSTER POWER SUPPLY

A. Install Remote NAC Power Supplies (boosters) at the locations shown on the drawings, as required, to minimize NAC voltage drops. Remote NAC power supplies shall be treated as peripheral NAC devices and shall not be considered fire alarm control units.

B. The NAC power supplies shall be fully enclosed in a surface mounted steel enclosure with hinged door and cylinder lock, and finished in red enamel. Door keys shall be the identical to FACP enclosure keys. The enclosure shall have factory installed mounting brackets for additional UL listed fire alarm equipment within its cabinet. Enclosures shall be sized to allow ample space for interconnection of all components and field wiring, and up to 10AH batteries. The enclosure shall have provisions for an optional tamper switch.

All FACP addressable control modules required to initiate the required NAC power supply output functions shall be installed within the NAC power supply enclosure

C. Remote NAC power supply *input* circuits shall be configurable as Class B supervised inputs or for connection to any 6 to 45 VDC initiation source.

D. Remote booster power supplies shall provide four (4) synchronized Class B supervised or two (2) Class A, power limited, 24VDC filtered and regulated Notification Appliance Circuits (NACs). Each NAC output shall be configurable as a continuous 24Vdc auxiliary power output circuit. The booster power supply shall be capable of a total output of <6> 10 amps.

E. The power supply NACs shall be configurable to operate independently at any one of the following rates: continuous synchronized, or 3-3-3 temporal. It shall be possible to configure the NACs to follow the main FACP NAC or activate from intelligent addressable synchronized modules. All visible <audible> NACs within the facility shall be synchronized.

F. Upon failure of primary AC power, the remote power supply shall automatically switch over to secondary battery power without losing any system functions. It shall be possible to delay reporting of an AC power failure for up to 6 hours. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as locally as battery trouble. All power supply trouble conditions (DC power failure, ground faults, low batteries, and IDC/NAC circuit faults) shall identify the specific remote power supply affected at the main FACP. All power supply trouble conditions except loss of AC power shall report immediately. Interconnecting NAC Booster power supplies in a manner which prevents identification of an individual power supply trouble shall not be considered as an equal.

G. The remote booster power supply shall be capable of recharging up to 24AH batteries to 70% capacity in 24 hours maximum. Batteries provided shall be sized to meet the same power supply performance requirements as the main FACP, as detailed elsewhere in this specification.

H. All AC power connections shall be to the building's designated dedicated emergency electrical power circuit. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each remote NAC power supply the disconnect serves.

I. The remote NAC power supplies shall be EDWARDS model BPS/APS series devices.

2.13 REMOTE ANNUNCIATOR

A. Provide a UL864 listed <semi-flush><surface> mounted remote annunciator at the location(s) shown on the drawings.

B. The annunciator shall utilize standard fire alarm user interface components to provide the ability to operate the Fire Alarm Control Panel functions from alternate locations within the building. The annunciator shall be capable of receiving the same event information and issuing the same system commands as the FACP to which it is connected, as

specified in the functional matrix elsewhere in this specification. <Functions shall include live page messages.>

C. The following common indicators and controls shall be provided on the annunciator.

1. The annunciator shall include an integral fire alarm LCD text annunciator. Annunciator Power, Alarm, Supervisory, Trouble, and Signal Silenced LEDs; System Reset, Silence, Trouble Silence, Drill and Lamp Test push buttons

D. The remote annunciator shall be equipped with a key locked see-through door mounting. The annunciator shall be powered by a battery backed up nominal 24 VDC power source.

E. The fire alarm remote annunciator shall be EDWARDS 3-ANN series annunciator.

2.14 ADDRESSABLE DETECTORS

A. General Requirements for Intelligent Addressable Heat, Smoke and CO Detectors

B. Each detector shall contain an integral microprocessor which shall determine if the device is normal, in alarm, or has an internal trouble. The microprocessor's non-volatile memory shall permanently store the detector's serial number, device type and system address. It shall be possible to address each intelligent device without the use of switches. Devices requiring switches for addressing shall not be considered as equal. Memory shall automatically be updated with the hours of operation, last maintenance date, number of alarms and troubles, time of last alarm, and analog signal patterns for each sensing element just before the last alarm.

C. Each detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

D. Each addressable detector on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent detector's programmed system response functions shall be associated with the detector's actual *location* on the signaling line circuit and *not with the detector's address*. After system commissioning, detectors improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its detector's address.

E. A status indicator shall be provided on each detector. Flashing green shall indicate normal operation; flashing RED shall indicate the alarm state. The indicator shall be visible from any direction.

F. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced, without the need for reprogramming. System shall

display an off-normal condition until the proper detector type is installed or a change in the device type profile has been made.

G. Detectors shall be rated for operation in the following environment unless specifically noted:

1. Temperature: 32°F to 120°F (0°C to 49°C)
2. Humidity: 0-93% RH, non-condensing

H. Detectors with addressing components in the base shall not be considered as equal.

I. The intelligent detectors shall be EDWARDS Signature Series devices.

J. Please refer to the General, *System Description* Section for site-specific detector operating requirements.

2.15 PHOTOELECTRIC DETECTOR

A. Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings.

B. When mounted in a sounder base, the detector shall initiate a temporal 3-3-3 when smoke is detected.

C. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to4,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.

D. Each smoke detector shall be individually programmable to operate at any one of five (5) sensitivity settings. The detector shall also store pre-alarm and alternate pre-alarm sensitivity settings. Pre alarm sensitivity values shall be configurable in 5% increments of the alarm and alternate alarm sensitivity settings respectively. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel. It shall be possible to automatically change the sensitivity of individual intelligent addressable smoke detectors for day and night (alternate) periods.

E. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

F. The photoelectric smoke detector shall be an EDWARDS SIGA-PD.

2.16 DUCT SMOKE DETECTOR

A. Provide intelligent low profile photoelectric duct smoke detectors / remote test switches at the locations shown on the drawings.

B. The intelligent duct smoke detector shall operate in ducts having from 100ft/min to 4,000ft/min air velocity. The detector shall be suitable for operation over a temperature range of -20 to 158F° and offer a harsh environment gasket option. The detector shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten (10) feet. Design of the detector shall permit sampling tube installation from either side of the detector and permit sampling tube installation in 45- degree increments to ensure proper alignment with duct airflow. Drilling templates and gaskets to facilitate locating and mounting the housing shall be provided.

C. The intelligent duct smoke detector shall obtain information from a photoelectric sensing element. The detector shall be able to differentiate between a long term drift above the pre alarm threshold and fast rise above the threshold. The detector shall monitor the sensitivity of the smoke sensor. If the sensitivity shifts outside the UL limits, a trouble signal shall be sent to the panel

D. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure. The detector shall provide a maintenance alert signal when 80% (dirty) of the available compensation range has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.

E. The intelligent duct smoke detector shall provide a form “C” auxiliary alarm relay rated at 2amps @ 30Vdc. The position of the relay contact shall be supervised by the control panel software. Operation of the relay shall be controlled either by its respective detector processor or under program control from the control panel as required by the application. Detector relays not capable of programmed operation independent of the detector’s state shall not be considered as equal. The detector shall be equipped with a local magnet-activated test switch.

F. Each duct detector shall be installed and testing in accordance with manufacturer’s instructions, including pressure differential and, velocity testing. Test results shall be submitted to the owner.

G. Remote test switches/LED indicators shall be provided below the detector on the ceiling to indicate location of the detector in non-mechanical areas, at locations indicated on the drawings.

H. The Intelligent Photoelectric Duct Smoke Detector shall be an EDWARDS model SIGA-SD.

I. The remote key operated test switch / LED shall be a EDWARDS model SD-TRK

2.17 DUCT MOUNTING PLATE

A. Where addressable smoke detectors are directly mounted on a low velocity ducts up to 3 ft (0.91m) high x 3 ft (0.91m) wide, provide factory mounting plate assemblies to facilitate mounting the detectors. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish. The detector mounting plate shall support an addressable detector along with a standard, relay or isolator detector mounting base.

B. The detector mounting plate shall be an EDWARDS SIGA-DMP.

2.18 FIXED HEAT DETECTOR

A. Provide intelligent fixed temperature heat detectors at the locations shown on the drawings.

B. The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135ºF (57ºC). The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.

C. The heat detector shall be rated for ceiling installation at a minimum of 50 ft (15.24m) centers and also be suitable for wall mount applications.

D. The Intelligent fixed temperature detector shall be an EDWARDS SIGA-HFD.

2.19 RATE OF RISE DETECTOR

A. Provide intelligent combination fixed temperature / rate-of-rise heat detectors at the locations shown on the drawings.

B. The detector shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The detector shall utilize a low mass thermistor heat sensor and operate at a nominal fixed temperature alarm point rating of 135ºF and at a temperature rate-of-rise alarm point of 15ºF per minute. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of thermistor data. Systems using central intelligence for alarm decisions shall not be considered as equal.

C. The heat detector shall be rated for ceiling installation at a minimum of 50 ft centers and also be suitable for wall mount applications.

D. The Intelligent combination fixed temperature / rate-of-rise heat detector shall an EDWARDS SIGA-HRD.

2.20 STANDARD BASE

A. Provide standard detector bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, European BESA or 1-gang box.

B. The bases shall utilize a twist-lock design and provide screw terminals for all field wiring connections.

C. The base shall contain no active electronics and support all Signature series detector types.

D. The base shall be capable of supporting a Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

E. Removal of the respective detector shall not affect communications with other detectors.

F. The standard addressable detector base shall be an EDWARDS SIGA-SB or SB4.

G. The remote LED indicator shall be an EDWARDS SIGA-LED

2.21 MANUAL STATIONS GUARDS

A. Provide manual pull station guards at the locations shown on the drawings.

B. The guard shall consist of a factory-fabricated clear polycarbonate enclosure, hinged at the top. Lifting the cover shall provide access to the manual pull station and activate an integral battery powered audible horn intended to discourage false alarms.

C. The manual pull station guards shall EDWARDS STI-1000 Series.

2.22 MODULES

A. Intelligent addressable multifunction modules shall be provided at the locations shown on the drawings to provide the specific system input and output functions described by the operation section and functional matrix found elsewhere in this specification.

B. The operation of multifunction modules shall be software configurable at the site to meet operational conditions, and may be changed at any time by download changes from the control panel. The intelligent multifunction modules shall utilize electronic addressing. Modules using rotary or DIP switches, memory chips and / or jumpers for addressing shall not be considered as equal.

C. Each intelligent multifunction module on the Signaling Line Circuit (SLC) shall transmit information regarding its location with respect to other intelligent devices on the signaling line circuit to the control panel, creating an "As-Built" circuit map. The circuit mapping function shall provide location supervision of all intelligent devices on the signaling line circuit. An intelligent device's programmed system response functions shall be associated with the device's actual *location* on the signaling line circuit and *not with the device's address*. After system commissioning, devices improperly installed in the wrong location shall function according to the mapped programmed response for its *location* on the circuit, not its device address.

D. All input /output status decisions shall be made by the microprocessor within the module. Communications with a control panel shall not be required in order for the module to identify off-normal input/output conditions. Modules with supervised input or output circuits shall be capable of identifying ground fault conditions down to the module address level.

E. Each module shall be equipped with two (2) diagnostic indicators; a green LED to confirm communications and a red LED to display active status. LEDs shall be visible through the finished cover plate. The module shall be capable of storing a unique serial number and up to 24 diagnostic codes, hours of operation, number of alarms and troubles, and time of last alarm in its memory which can be retrieved for troubleshooting.

F. Modules shall be rated for operation in the following environment:

1. Temperature: 32°F to 120°F (0°C to 49°C)
2. Humidity: 0-93% RH, non-condensing

G. Where multiple modules are mounted in close proximity to each other, plug-in modular versions of the modules and motherboards shall be available to minimize field wiring and facilitate troubleshooting.

H. The addressable multifunction modules shall EDWARDS Signature Series devices.

I. Please refer to the *General,* System *Description Section* for site-specific module operating requirements.

2.23 ONE INPUT MONITOR

A. Provide addressable single input multifunction modules at the locations shown on the drawings.

B. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

C. Each module shall provide one (1) supervised Class B input circuit configurable as one of the following "personalities."

1. Normally-Open Alarm Latching (for alarm initiation applications)
2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
4. Normally-Open Active Latching (for tamper switch and supervisory applications)

D. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuit, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

E. The Intelligent Single Input Module shall be an EDWARDS SIGA-CT1.

2.24 TWO INPUT MONITOR

A. Provide addressable dual input multifunction modules at the locations shown on the drawings.

B. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

C. Each module shall provide two (2) supervised Class B input circuit configurable as one of the following "personalities."

1. Normally-Open Alarm Latching (for alarm initiation applications)
2. Normally-Open Alarm Delayed Latching (for waterflow switch applications)
3. Normally-Open Active Non-Latching (for limit switch and monitor applications)
4. Normally-Open Active Latching (for tamper switch and supervisory applications)

D. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

E. The Addressable Dual Input Module shall be an EDWARDS SIGA-CT2.

2.25 NOTIFICATION CIRCUIT

A. Provide addressable notification appliance circuit modules at the locations shown on the drawings.

B. The module shall be suitable for mounting in North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers.

C. The addressable NAC module shall provide one (1) supervised Class A notification appliance circuit.

D. The NAC control module shall be configurable for the following operations:

1. 24 VDC synchronized NAC circuit, 2 amps @ 24 VDC.
2. Audio notification circuit 25Vrms @ 50 watts or 70 Vrms @ 35 watts
3. Firefighter's Telephone control with ring tone

E. The addressable notification appliance circuit module shall be an EDWARDS SIGA-CC1(S) or MCC1(S)

2.26 RELAY

A. Provide addressable control relay modules at the locations shown on the drawings.

B. The module shall be suitable for mounting on a North American 2 ½" (64mm) deep 1-gang box or 1 ½" (38mm) deep 4" square box with 1-gang covers.

C. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The relay coil shall be magnetically latched to reduce wiring and ensure 100% of the relays on the SLC can be energized at same time.

D. The addressable control relay module shall be an EDWARDS SIGA-CR or MCR.

2.27 WATERFLOW AND-TAMPER

A. Connect to all sprinkler switches

B. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

C. Each module shall provide two (2) supervised Class B input circuit configured as:

1. Normally-Open Alarm Delayed Latching for waterflow switch applications.
2. Normally-Open Active Latching for tamper switch and supervisory applications.

D. Each module shall identify and report by device address, ground faults and opens associated with its initiating device circuits, to the control panel. Modules or without

individual ground fault detection identification capability shall not be considered as equal.

E. The Addressable Dual Input Module shall an EDWARDS SIGA-WTM.

2.28 ISOLATION MODULE

A. Provide addressable isolator modules at the locations shown on the drawings.

B. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.

C. In the event the Class A signaling line circuit on which the intelligent isolator module is installed is shorted, each module shall open the SLC. Isolator modules shall then sequentially reconnect the isolated circuit segments until only the segment with the short is left out of the circuit, leaving the balance of the circuit operational.

D. <SLC isolation shall be provided for each floor or protection zone of building.>

E. The addressable Isolator Module shall be an EDWARDS SIGA-IM.

2.29 UNIVERSAL MODULES

A. Provide intelligent universal Class A/B multifunction modules at the locations shown on the drawings.

B. The module shall be suitable for mounting on North American 2½" (64mm) deep 2-gang boxes and 1½" (38mm) deep 4" square boxes with 2-gang covers.

C. Each universal module shall be configurable as one of the following "personalities."

1. Two (2) supervised Class B Normally-Open Alarm Latching. (for alarm initiation applications)
2. Two (2) supervised Class B Normally-Open Alarm Delayed Latching. (for waterflow switch applications)
3. Two (2) supervised Class B Normally-Open Active Non-Latching. (for limit switch and monitor applications)
4. Two (2) supervised Class B Normally-Open Active Latching. (for tamper switch and supervisory applications)
5. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc. (for circuit control applications)
6. One (1) supervised Class A Normally-Open Alarm Latching. . (for alarm initiation applications)
7. One (1) supervised Class A Normally-Open Alarm Delayed Latching. . (for waterflow switch applications)
8. One (1) supervised Class A Normally-Open Active Non-Latching. (for limit switch and monitor applications)
9. One (1) supervised Class A Normally-Open Active Latching. . (for tamper switch and supervisory applications)
10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)

11. One (1) supervised Class B 2-wire Smoke Alarm Non-Verified. (for alarm initiation applications)
12. One (1) supervised Class A 2-wire Smoke Alarm Verified (for alarm initiation applications)
13. One (1) supervised Class B 2-wire Smoke Alarm Verified(for alarm initiation applications)
14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.(for occupant notification applications)
15. One (1) supervised Class B Signal Circuit, 24Vdc @ 2A. .(for occupant notification applications)

D. Each module shall identify and report ground faults, opens and shorts associated with its supervised input / output circuits, by device address, to the control panel. Single function modules or without individual ground fault detection identification capability shall not be considered as equal.

E. The Universal Class A/B Module shall an EDWARDS SIGA-UM.

2.30 NOTIFICATION APPLIANCES

A. All appliances supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the “equivalent facilitation” which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.

B. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer’s instructions.

C. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

D. All strobes shall be provided with lens markings oriented for wall mounting. Exterior mounted devices shall be provided with a weatherproof backbox.

E. All visual appliances shall be synchronized. Light and audible output levels shall be designed to meet ADA and NFPA requirements

F. All notification appliances shall be <red><white> unless noted otherwise on the drawings.

2.31 STROBES

A. Provide low profile wall mounted strobes at the locations shown on the drawings.

B. Low profile strobes shall mount in a North American 1-gang box, and protrude less than 1” from the finished wall. The word FIRE <ALERT> shall be prominently displayed on the housing.

C. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "FullLight" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.

D. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

E. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

F. The strobes shall be EDWARDS Genesis G1 Series.

2.32 STROBES-WEATHERPROOF

A. Provide low profile weatherproof strobes at the locations shown on the drawings.

B. The weatherproof strobes shall mount in a North American 4" square 1 ½"deep electrical box for indoor applications and a factory supplied back box for weatherproof applications.

C. The strobe shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word FIRE shall be prominently displayed on the housing.

D. The strobe output shall be switch selectable as required by its application from the following available settings:

		Standard Candela Output Strobes				High Candela Output Strobes			
		Strobe Switch Position							
Listing	Location	D	C	B	A	D	C	B	A
UL 1971	Indoor	15 cd	29 cd	70 cd	87 cd	102 cd	123 cd	147 cd	161 cd
UL 1638	Outdoor (-35C)	6 cd	12 cd	28 cd	35 cd	41 cd	50 cd	60 cd	65 cd

E. Selected strobe rating shall be visible when the speaker-strobe is in its installed position

F. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

G. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

H. The weatherproof strobes shall be EDWARDS Genesis WG4 Series.

2.33 HORN-STROBES

A. Provide low profile wall mounted horn-strobes at the locations shown on the drawings.

B. Low profile horn-strobes shall mount in a North American 1-gang box, and protrude less than 1" from the finished wall. The word FIRE shall be prominently displayed on the housing. The word FIRE <ALERT> shall be prominently displayed on the housing.

C. The horn-strobe shall provide an audible output of 85 dBA at 10 ft. when measured in reverberation room per UL-464, and have a selectable steady or synchronized temporal (3-3-3) output pattern.

D. The strobe output shall be switch selectable as required by its application from the following available settings: 15cd, 30cd, 75cd & 110cd. Selected strobe rating shall be visible when the horn-strobe is in its installed position. Amber lens strobes shall be available with outputs of 12/24/60/88cd. Light shall be evenly distributed throughout the required volume using cavity and mask "FullLight" technology to prevent hot spots. Strobes using specular reflectors shall not be considered as equal.

E. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

F. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

G. The horn-strobes shall be EDWARDS Genesis G1 Series.

2.34 Horn-Strobes-Weatherproof

A. Provide low profile weatherproof horn-strobes at the locations shown on the drawings.

B. The weatherproof horn-strobes shall mount in a North American 4" square 1 ½"deep electrical box for indoor applications and a factory supplied back box for weatherproof applications.

C. The horn-strobe shall be suitable for wall or ceiling mount and operate in temperatures from -40 to 151 degrees F. The word FIRE shall be prominently displayed on the housing.

D. The horn-strobe shall provide a user configurable high/low audible output of 89.7/85.4 dBA @ 10' for a steady output and an 84.2/81.7 4 dBA @ 10' for a temporal (3-3-3) output when measured in reverberation room per UL-464.

E. The strobe output shall be switch selectable as required by its application from the following available settings:

		Standard Candela Output Horn-Strobes	High Candela Output Horn-Strobes
		Strobe Switch Position	

Listing	Location	D	C	B	A	D	C	B	A
UL 1971	Indoor	15 cd	29 cd	70 cd	87 cd	102 cd	123 cd	147 cd	161 cd
UL 1638	Outdoor (-35C)	6 cd	12 cd	28 cd	35 cd	41 cd	50 cd	60 cd	65 cd

F. Selected strobe rating shall be visible when the speaker-strobe is in its installed position

G. When multiple strobes are installed within view of each other, their outputs shall be synchronized within ten (10) milliseconds of each other for an indefinite period without the need for separate synchronization modules.

H. Horn and strobe power, horn silencing, and strobe synchronization shall be accomplished over a single pair of wires. In and out screw terminals shall accommodate 18AWG to 12 AWG wiring and have captive hardware.

I. The weatherproof horn-strobes shall be EDWARDS Genesis WG4 Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams.

B. All work shall be performed in accordance with the requirements of NFPA 70 and NFPA 72.

C. Coordinate locations of all devices with all other divisions' drawings and specifications.

D. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the contract drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer.

E. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

F. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.

G. No wiring except life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures.

H. Any low-voltage copper wiring that leaves the protection of a building shall be provided with a compatible UL 497B listed transient protection devices where the circuit leaves the building and where it enters the next building.

I. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled such that removal of the device is not required to identify the EOL device.

J. Fiber Optic Cable

1. Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
2. ST connectors shall be used at all equipment terminations.

K. Concrete floors shall be X-rayed prior to core drilling on post tension slabs. Verify with engineer on type of slab prior to bid.

3.2 ELECTRICAL

A. BOXES, ENCLOSURES AND WIRING DEVICES

1. Boxes shall be installed plumb and firmly in position.
2. Extension rings with blank covers shall be installed on junction boxes where required.
3. Junction boxes served by concealed conduit shall be flush mounted.
4. Fire alarm system junction box covers shall be painted red.
5. Wiring within cabinets, enclosures, boxes, junction boxes and fittings shall be installed in a neat and workmanlike manner, installed parallel with or at right angles to the sides and back of any box, enclosure or cabinet, and routed to allow access for maintenance. All conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved pressure type terminal blocks, which are securely mounted. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. No more than two conductors shall be installed under one connection. Wire nuts, crimp splices and similar devices shall not be used.

B. CONDUCTORS

1. Each conductor shall be identified as shown on the drawings at terminal points. Permanent wire markers shall be located within 2 inches of the wire termination. Marker text shall be visible with protective doors or covers removed.
2. Maintain a consistent color code for fire alarm system conductor functions throughout the installation.
3. All wiring shall be installed in compliance with the National Electric Code, NFPA 70, and the equipment manufacturer’s requirements.
4. Wiring for Signaling Line Circuit and Initiating Device Circuit field wiring shall be solid copper, No. 18 AWG twisted pair conductors at a minimum. Speaker circuits; 16 AWG twisted pair at a minimum. Telephone circuits shall be 18 AWG twisted-shielded pair at a minimum. 24VDC visual and audible Notification Appliance Circuits shall be solid copper No. 14 AWG size conductors at a minimum. The wiring sizes listed herein are minimum sizes. Use larger wire sizes when recommended by the manufacturer, based on system configuration and project specific calculations.

5. Where shielded wiring is used, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP or other control equipment. Shields shall be continuous, treated as a third conductor, and insulated from ground except as noted.
6. T-taps (branches) are permitted in Style 4 SLC circuits with interconnections occurring on terminal strips.
7. Circuits to third-party systems (HVAC, Elevators, fire pumps, etc.) shall terminate in terminal cabinets within three (3) feet of the controllers for those systems.
8. AC power wiring shall be No. 12 AWG solid copper having insulation rated for 600 volts.
9. Crimp type spade lugs shall be used for terminations of stranded conductors to binder screws or stud type terminals.
10. All wiring shall be checked and tested to insure that there are no grounds, opens or shorts.

C. DEVICES

1. All devices and appliances shall be mounted to or in an approved electrical box.

D. Raceways

1. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
2. Install all conductors in rigid metal conduit or electro-metallic tubing, utilizing compression type fittings and couplings, with a minimum diameter 3/4". The use of flexible metal conduit not exceeding a six (6) foot length shall be permitted for initiating device circuits.
3. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or fire damage, and shall not to interfere with existing building systems, facilities or equipment.
4. Run conduit or tubing concealed in finished areas unless specifically shown otherwise on the drawings. Conduit may be exposed in unfinished mechanical/electrical rooms, and basement levels.
5. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back box locations shall be readily accessible for inspection, testing, service and maintenance.
6. Open cable NOT ALLOWED.

E. Power Limited cable, when not installed in UL listed metal conduit or raceway, shall be mechanically protected by building construction features par NFPA 70, Article 760.

1. Installation shall be in areas not subjected to mechanical injury.
2. All circuits shall be supported by the building structure. Cable shall be attached by straps or bridal rings to the building structure at intervals not greater than 10 feet. The use of staples is prohibited. Fire alarm wiring shall not be bundled or strapped to existing conduit, pipe or wire in the facility.
3. Where wiring is installed above drop ceilings, cable shall not be laid on ceiling tiles.
4. Cable shall not be fastened in a manner that puts tension on the cable.

F. Power Limited Cable shall be FPLP, FPLR or FPL, or permitted substitute.

3.3 FA COMPONENTS

A. DEVICES

1. All devices and appliances shall be mounted to or in an approved electrical box.
2. All wall mounted *control equipment* shall comply with requirements defined by the International Building Code and Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems (AC-156) using a seismic component importance factor of 1.5.

B. Fire Alarm Control Panels

1. Mount the enclosure with the top of the cabinet 72” above the finished floor or center the cabinet at 63”, whichever is lower.
2. Label the fire alarm panels with the room number, electrical panel number and circuit breaker number feeding them.
3. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
4. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.
5. Grounds shall comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

C. Remote Annunciator

1. Mount the panel; with the top of the panel 72” above the finished floor or center the panel at 63”, whichever is lower.

D. Remote power supplies and auxiliary fire alarm panels

1. Locate the panel or cabinet with the top of the panel 72” above the finished floor or center the panel at 63”, whichever is lower.
2. Do not locate these panels above ceilings or where inaccessible by a person standing on the finished floor of the space.
3. Label the power supplies and auxiliary FACPs with the room number, electrical panel number and circuit breaker number feeding them.
4. Paint the handles of the dedicated circuit breakers feeding fire alarm panels red, and install handle locks.
5. Within the panel, all non-power limited wiring must be properly separated from power limited circuits.

E. Manual Pull Stations

1. Mount stations so that their operating handles are between 42” and 48” above the finished floor.

F. Notification Appliances: Mount assemblies as follows:

1. All wall mounted audio/visual devices shall be mounted so the entire lens is between 80” and 96” above the finished floor. Where low ceilings exist, devices shall be mounted within 6” of the ceiling.
2. Each speaker’s (horn) output shall be set to the wattage value indicated for its specific location as shown on the drawings.
3. Each strobe’s output shall be set to the candela value indicated for its specific location as shown on the drawings.
4. Each speaker (horn)-strobe’s outputs shall be set to the wattage/candela value indicated for its specific location as shown on the drawings.
5. Where ceiling height exceeds 30 feet, appliances shall be suspended from the ceiling to a height of 30 feet maximum above the finished floor.
6. Appliances installed outdoors shall be UL listed for outdoor use.

G. Smoke Detectors:

1. Smoke and heat detector heads shall not be installed until after construction clean-up is completed. Detector heads installed prior to construction clean-up shall be cleaned by the manufacturer or replaced.
2. Detectors located on the wall shall have the top of the detector at least 4" and not more than 12” below the ceiling.
3. On smooth ceilings, detectors shall not be installed over 30 ft. apart in any direction.
4. Install smoke detectors no closer than 3 ft. from air handling supply air diffusers or return air openings.
5. Locate detectors no closer than 12” from any part of a lighting fixture.

H. Duct Smoke Detectors:

1. Install sampling tubes so they extend the full width of ducts exceeding 36”.
2. Detectors shall be located to facilitate ease of maintenance.
3. All penetrations near detectors located on/in return ducts shall be sealed to prevent air entry.

I. End-of-Line Resistors

1. Devices containing end-of-line resistors shall be appropriately labeled.

J. Remote Status and Alarm Indicators:

1. Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

K. Heat Detectors

1. Heat detectors shall be installed in strict accordance with their UL listing and the requirements of NFPA 72.
2. Heat detectors installed in the elevator machinery room to meet ANSI A17.1 requirements for elevator power disconnect, shall be located adjacent to each sprinkler head. Coordinate temperature rating and location with sprinkler rating and location.

L. Addressable Control (relay) Modules

1. Install the module less than 3 feet from the device controlled.
2. Orient the device mounting for best maintenance access.
3. Label all addressable control modules as to their function.
4. Provide a dedicated 24VDC circuit to feed all auxiliary relays required for inductive loads (auxiliary relays, door holders). Circuits shall be supervised via an end-of-line relay and addressable input module. Auxiliary relays shall not derive their power from the starter or load being controlled.

3.4 FIRE STOPPING

A. Provide fire stopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with the fire stopping provisions of this contract.

3.5 TEST AND INSPECTION - FIRE

A. Testing, general

1. In addition to tests required in this section, the contractor shall perform all electrical and mechanical tests required by the equipment manufacturer, the architect and the authority having jurisdiction.
2. The contractor shall perform all testing in occupied facilities at times of day that present the lowest impact and disruption to business and activities. Coordinate all testing in occupied buildings with the building owner’s representative to assure that fire alarm system testing does not interrupt operations. This may require extensive after hours work to perform such testing.>
3. All equipment, instruments, tools and labor required to conduct the system tests shall be provided by the installing contractor. At a minimum, the following equipment shall be made available testing:

    a. Ladders and scaffolds as required to reach all installed equipment.
    b. Meters for reading voltage, current and resistance.
    c. Two-way communication devices
    d. Simulated smoke, heat-producing devices for heat detectors, extension poles for introducing smoke into detectors, as needed.
    e. Manufacturer’s instruments to measure air flow through duct smoke detectors.
    f. Decibel meter.
    g. Status and diagnostic software and PC.

B. All testing shall utilize a written acceptance test plan for testing the system components and operation in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the acceptance test plan, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and system programming.

1. The systems operation matrix created by the equipment supplier shall be used to identify each alarm input and verify all associated output functions.

C. The system test plan shall include but not be limited to the following:

1. Visually inspect all wiring.
2. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final acceptance test.
3. System wiring shall be tested to demonstrate correct system response for the following conditions:

    a. Open, shorted and grounded signal line circuits.
    b. Open, shorted and grounded notification appliance circuits.

D. System indications shall be demonstrated as follows:

1. Correct message content for each alarm input at all system displays.
2. Correct annunciator light for each alarm input at each graphic display.
3. Correct history logging for all system activity.
4. Correct sensitivity for all smoke detection devices. The use of system generated sensitivity reports is acceptable in meeting this requirement.

    a. Correct signals sent to the Central Monitoring Station.

5. Notification appliances shall be demonstrated as follows:

    a. All alarm notification appliances actuate as programmed
    b. Audibility and visibility at required levels. Measure sound levels at 5 ft. above finished floor with the room doors closed.
    c. For 24VDC NACS, measure and record the voltage at the most remote appliance on each notification appliance circuit, while operating.

6. System control functions shall be demonstrated as follows:

    a. In accordance with the system operation matrix.

7. System off premises reporting functions shall be demonstrated as follows:

    a. Correct information received for each alarm and trouble event

8. Secondary power supply (battery) capacity capabilities shall be demonstrated as follows:

    a. System battery voltages and charging currents shall be measured and recorded at the fire alarm control panels.
    b. System primary power shall be disconnected for <24 hours>. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of <5 minutes>.
    c. System primary power shall be restored for forty-eight (48) hours.
    d. System battery voltages and charging currents shall again be measured and recorded at the fire alarm control panels.

9. Verify the “As Built” record drawings are accurate.

E. Preliminary Testing

1. Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of the written test plan. Correct any deficiencies, omissions or anomalies and retest the affected devices to assure proper function per the specification.

F. Acceptance Testing

1. A final acceptance test shall not be scheduled until the system manuals are provided to and approved by the owner and the following are provided at the job site:

   a. (1) “As Built” record drawings of the system as actually installed
   b. (2) A copy of the system operation matrix.

2. The acceptance inspector shall use the system “As Built” record drawings in combination with the system operation matrix and the written acceptance test plan during the testing to verify system operation.
3. Should the system not perform to the above criteria it shall not be accepted and the contractor shall correct all deficiencies and shall re-test the system at contractor's expense in the presence of the architect using the same test criteria.
4. The building owner’s representative shall witness the final tests.
5. The central monitoring station and/or fire department shall be notified before final test in accordance with local requirements.
6. Operate every installed device to verify proper operation and correct annunciation at control panel.
7. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

G. Test Reports

1. A "Fire Alarm System Record of Completion" per the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in shall be prepared by the Contractor. Submit three (3) copies to the Architect. The report shall include, but not be limited to:

   a. A list of all equipment installed and wired.
   b. Certification that all equipment is properly installed and functions and conforms with these specifications.
   c. Sensitivity settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
   d. Technician's name, certificate number and date.

END OF SECTION 283111

SECTION 311000 – SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. Work includes but is not limited to the following:

1. Establish clearing limits and vegetation to remain.
2. Protection of existing trees to remain.
3. Clearing site of trees, shrubs, root masses, and other vegetation.
4. Removal of slabs, pavements and other improvements.
5. Removal and disposal of materials from site according to regulatory requirements.
6. Protect from harm any trees, vegetation, existing structures, utilities, pavements, sidewalks, curbs, or other objects selected to remain.

B. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:

1. Section 013323 “Submittal Procedures”
2. Section 015700 “Erosion Control”
3. Section 311000 “Earth Moving”

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction herein referred to as the Standard Specifications
2. Standard Plans: WSDOT/APWA Standard Plans for Road, Bridge, and Municipal Construction
3. Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report for Proposed Western State Hospital Commissary and Kitchen Building, by Associated Earth Sciences, Inc. dated September 27, 2017

B. Limited Topographic Site Survey prepared by Axis Surveying and Mapping, dated January 5, 2010.

1.4 SUBMITTALS

A. General: Comply with Section 013323 “Submittal Procedures”.

B. Submit demolition procedures and operational sequence for review and acceptance by Owner.

C. Permits for transport and disposal of debris as required.

1.5 DESCRIPTION

A. Construct and maintain erosion and sedimentation control in accordance with contract documents City of Lakewood requirements. Clear and grub site as indicated and as necessary to construct improvements. Save and protect from harm any trees, vegetation, or other objects selected to remain. Remove from area to be cleared all other growth unless otherwise indicated or directed.

1.6 EXISTING CONDITIONS

A. Protection of Existing Improvements

1. Provide, erect, and maintain barricades, coverings, or other types of protection necessary to prevent damage to existing improvements.
2. Restore any existing improvements damaged by this work to their original condition, as acceptable to Owner.

B. Objectionable Noises: Conform with local governing requirements regarding Noise Control.

C. Maintain vehicular and pedestrian traffic routes:

1. Ensure minimum interference with roads, streets and adjacent facilities.
2. Do not close or obstruct streets, fire lanes, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

1.7 DIMENSIONS AND LAYOUTS

A. The Contractor will be responsible for furnishing, setting and marking all line and location stakes, including offsets and general construction staking. When work requiring control is being performed, all necessary related equipment, supplies and instruments shall be on site. A Professional Surveyor must be assigned to the Contractor's crew for this work. This equipment and personnel must be available, at no additional cost to the

owner for the purpose of verifying layout, conformance of grading design, and certifying the accuracy of work on the site.

B. The Contractor is responsible for preserving all benchmarks and stakes and the replacement of any that are displaced or missing.

PART 2 - PRODUCTS

2.1 TEMPORARY FENCING

A. Temporary chain link fencing: minimum 6’ height, line posts at 8’ o.c. maximum. 2” chain link mesh fence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify limits of clearing, grubbing, and site improvement removal with Owner prior to commencing work.

B. Obtain required permits and permission from local governing authorities and Owner prior to commencing work.

C. Prior to beginning site removals and clearing, meet with Owner’s Representative and review all proposed utility layouts on site. Indicate all existing trees, shrubs and landscaping as well as site improvements that will be affected by construction. Coordinate removals of landscape materials with Owner.

D. The Contractor is responsible for review of all utility purveyor, and City or State records relative to the existing underground utilities. The Contractor is responsible for avoiding damage to these facilities and shall restore all utilities at Contractor's own expense.

E. The Contractor is to notify the Owner’s Representative immediately if underground utilities not shown on the project documents are encountered.

3.2 PROTECTION

A. Identify existing structural foundations near excavations. Verify excavation will not undermine footings or supports and cause damage to structures.

B. Protect benchmarks, existing structures, sidewalks, railings, paving, and curbs.

C. Protect pavement or paved areas intended to remain from damage.

D. Use all means necessary to prevent the erosion of freshly graded areas during construction or until such time that permanent drainage and erosion control measures are fully operational.

E. Protect existing buildings scheduled for demolition but still occupied by the owner during work performed under this section.

F. Save and protect trees indicated on plans to remain. Protect all off-site trees along adjacent roadways and on surrounding properties.

G. Repair and/or repair of damaged facilities will be accomplished at the Contractor's expense.

H. Protect existing tunnels from construction vehicle loading. Install steel plates at tunnel crossings as needed. (Addendum 3)

3.3 TREE PROTECTION

A. Install construction fencing at the drip line of the trees prior to beginning any clearing or earthwork activities. Notify the Architect once tree protection is established to allow for review of tree protection.

B. Do not stockpile any material or allow any vehicular traffic within the limits of the tree protection fencing.

C. Any work within the tree protection fencing must be accomplished by hand methods only.

D. Roots of trees to be saved which are damaged during construction must be treated in the following way:

1. For damaged roots over 1" in diameter, make a clean, straight cut to remove the damaged portion of the root.
2. All exposed roots shall be temporarily covered with damp burlap or wood shavings to prevent drying and be covered with earth as soon as possible.

3.4 CLEARING

A. Contact utility location service and have all underground utilities on the site and adjacent right of ways clearly marked. For aid in utility location call "Dial Dig 1-800-424-5555," 48 hours (two working days) prior to beginning site clearing and demolition activities. Provide and pay for additional marking as required. Flag and protect existing underground utilities to remain.

B. Approximate locations of existing utilities have been obtained from available records and are shown for convenience. The contractor shall be responsible for verification of the locations shown and for discovery of possible additional utilities not shown so as to avoid damage or disturbance. The underground utility location service shall be contacted for field location prior to any construction. The Owner shall be contacted if a utility conflict exists.

C. Completely remove all roots, stumps, vegetation and all other organic debris within the clearing limits as required for new construction and as indicated. Perform removal operations in a manner to protect property.

D. Save and protect trees indicated on plans to remain. Protect all off-site trees along adjacent roadways and on surrounding properties.

E. Saw cut existing pavement completely through paving section prior to paving removal.

F. Strip topsoil, organics, loose silty fine sands, and soft surficial soils to its full depth within the clearing limits as described in the Engineering Plans. Do not strip more area than can be protected from moisture damage to underlying material. Protect plant life, lawns, and other features remaining as a portion of final landscaping or interim erosion control.

G. Remove and dispose of debris in an authorized manner.

H. Fill depressions caused by clearing operations with common fill, per Section 312000.

3.5 GRUBBING

A. General: Grub or otherwise prepare areas where clearing has occurred to receive construction or other improvements.

B. Excavate and remove all stumps to a minimum depth of at least 2'-0" below grade.

C. Excavate and remove roots larger than 2 inches in diameter, rocks, boulders, any remaining paving, and the like, as well as other unsuitable materials.

D. Use only hand methods for grubbing inside the greater of a 10-foot radius or the drip line (whichever is greater) of trees indicated to remain.

3.6 SITE IMPROVEMENT REMOVALS

A. Remove or abandon existing underground utilities per City of Lakewood standards, below the proposed building structure, and as shown on plans.

B. Existing underground utilities to be filled with CDF and capped in accordance with City of Lakewood Standards.

C. Sprinkle excavated material and access roads as necessary to limit dust to lowest practicable level. Do not use water to extent causing flooding, contaminated runoff or icing.

3.7 UTILITY SERVICES

A. Underground Utility Locations: Phone 1-800-424-5555 for location 48 hours prior to excavation.

B. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition.

1. Do not interrupt existing utilities service occupied or operating facilities, except when authorized in writing boy Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
2. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility requirements: Locate, identify, disconnect and seal or cap off indicated utility services to be removed that serve existing buildings.

1. Arrange to shut off utilities with utility company and/or owner as required.
2. Where utility services are required to be removed, relocated or abandoned, provide bypass connections to maintain continuity of service.

3.8 DRAINAGE

A. Keep designated drainage ways open for drainage at all times. Maintain and/or adjust erosion control facilities as required to prevent sediment transport either downstream or off-site. At no time shall more than one foot of sediment be allowed to accumulate within a catch basin, ditch or swale. All catch basins and conveyance ditches shall be cleaned prior to paving. Mud/sediment build-up shall be removed, and the cleaning operation shall not flush sediment-laden water into the downstream system.

B. The Contractor is responsible to provide temporary and permanent control of surface water and subsurface seepage to allow for site access, grading, construction of underground utilities, and paving. The contractor is solely responsible for protecting disturbed areas from inclement weather and surface runoff during construction process to provide a suitable working platform for all phases of the construction. Ground water from upgradiant sources shall be intercepted and routed around work area per geotechnical recommendations. The Contractor shall be familiar with and shall follow the geotechnical recommendations concerning subgrade protection.

C. Keep open pits and holes caused as a result of demolition work free of standing water.

3.9 TEMPORARY CONSTRUCTION WORKING SURFACES

A. The Contractor shall provide a construction working surface of sand and gravel, crushed rock, quarry spalls, ATB pavement, or other approved method to protect the onsite soils in areas of construction traffic.

1. Construction Working surfaces may be used as subgrade for permeant paving surfaces provided:

a. the working surface is established at the correct subgrade for the permanent pavement surfaces

b. the working surface is compacted, stabilized, and graded sufficiently to support he final pavement surface as verified by the Geotechnical Engineer.

2. Portions or all of the construction working surface may need to be removed prior to final paving if these conditions are not met.

3.10 DISPOSAL OF MATERIALS

A. Refuse from clearing and grubbing shall be disposed of by the Contractor in a manner consistent with government regulations. In no case shall refuse material be left on the project site, placed onto abutting private properties, or buried in embankments or trenches on the project site. Debris shall not be deposited in a stream or body of water, any public right of way or upon private property except by written consent of the private property owner. On-site burning is not allowed. Maintain hauling routes clean and free of debris resulting from work of this Section.

END OF SECTION 311000

SECTION 02200 – EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Excavation of unsuitable material.
2. Excavating, backfilling, and compacting for structures, pavements, and landscape areas.
3. Cutting, grading, and filling (earthwork).
4. Aggregate and soil materials for structures, slabs, pavements, and landscape areas.
5. Protection and conditioning of on site materials.
6. Exporting and disposing of unsuitable and excess soil material.
7. Importing and compacting fill material to replace unsuitable material.
8. Recycling and processing asphalt and concrete rubble for aggregate (Contractor option).

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 012200 “Unit Prices”
2. Section 013323 “Submittal Procedures”
3. Section 015700 “Erosion Control”
4. Section 311000 “Site Preparation”
5. Section 321200 “Asphalt Concrete Paving”
6. Section 331000 “Water Distribution”
7. Section 334100 "Storm Drainage"
8. Section 333000 "Sanitary Sewer System"

1.3 REFERENCES

A. WSDOT-APWA: Standard Specifications for Road, Bridge, and Municipal Construction, 2016

B. Standard Plans: WSDOT/APWA Standard Plans for Road, Bridge, and Municipal Construction

C. City of Lakewood Engineering Standards Manual (Current Edition)

D. Geotechnical Report

1. Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report for Proposed Western State Hospital Commissary and Kitchen Building, by Associated Earth Sciences, Inc. dated September 27, 2017.

1.4 SUBMITTALS

A. General: Comply with Section 013323 “Submittal Procedures”.

B. Samples: Submit minimum 50-pound sample for each material 4 business days prior to placing material.

C. Quality Assurance/Control Submittals

D. Test Reports: Sieve analysis for each material.

E. Certificates: WSDOT pit certification for each pit.

1.5 Sustainability Criteria

A. WSSP Submittals: Refer to Specification Section 013323, “Submittal Procedures” for additional requirements and submittals.

1. Product Data for Credits M2.1: For products having recycled content, documentation indicating percentages by weight of post-consumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit M2.5: List of proposed regional materials and regionally extracted and manufactured materials. Identify each regionally manufactured material, including quantity in the project, it source, cost, and the fraction by weight that is considered regional.

1.6 Base Bid:

A. Contractor shall include in the base bid the cost of achieving the final grades shown on the Contract Documents beginning with the existing conditions as represented in the site survey attached to, and included in, the Contract Documents; and the Geotechnical report (by reference). All excavation to suitable bearing soil, export, import, placement, and compaction required to achieve the final grades and completed structures, as shown in the contract documents, shall be included in the base bid.

1.7 Unit Prices

A. Over excavation: The unit price shall be applied to un-anticipated unsuitable soils as determined by the Owner’s appointed Geotechnical Engineer encountered below the anticipated sub grade elevation. Un–anticipated unsuitable material shall be that material below the sub-grade elevation that does not meet bearing capacity requirements as defined by the field Geotechnical Engineer.

1. The Contractor shall be responsible for measuring the quantity of un-anticipated unsuitable material that is removed. The Contractor shall measure in place bank yards by field measurement that shall be observed, verified, and documented by the Geotechnical Engineer prior to backfilling with imported structural fill. The Contractor shall note that measurement by truck tickets will not be accepted.
2. The Contractor will be compensated at his bid unit price for excavation and off-site disposal of un-anticipated soils only as verified and documented by the Geotechnical Engineer in the field. No compensation will be made to the Contractor for unverified and undocumented quantities.
3. The Contractor shall include in his basic bid the cost of over excavation and disposing of an assumed quantity of this material to be shown in the bid proposal as noted in the contract documents.

    a. If the full assumed quantity of this over excavation is not required due to favorable site conditions, the Contractor shall credit back to the Owner the value of the un-required over excavation at his stated unit price. The contract will be reduced by Change Order accordingly.
    b. If a quantity greater than the assumed quantity of over excavation is required, the Contractor shall perform this work at the unit price stated in his bid and the contract will be increased by Change Order accordingly.

4. Excavation and off-site disposal required to meet sub-grade elevations, as defined in the Contract Documents, shall be included in the base bid and shall not be compensated using unit prices.
5. If the Contractors sequencing of the Work requires stockpiling and double handling of materials, this shall be accomplished within the base bid amount at no additional cost to the Owner.

B. Additional Import: A unit price shall also be provided for import, placement and compaction of structural fill material for use in replacing over excavated un-anticipated unsuitable materials and/or as directed by the Geotechnical Engineer.

1. The Contractor will be compensated at his bid unit price for import material used only in replacing over excavated un-anticipated unsuitable materials as approved, verified and documented by the Geotechnical Engineer in the field. Only import required by field determined deviations in the actual depth to competent bearing soils from that shown in the Contract Documents shall be compensated using the unit price. Unit Price Shall be in Bank Yards.
2. The Contractor shall include in his basic bid the cost of such additional imported structural fill of an assumed quantity at the unit price to be shown in the bid proposal.

    a. If the full assumed quantity of this excess import is not required due to favorable site conditions, the Contractor shall credit back to the Owner the value of the un-required import at his stated unit price. The contract will be reduced by Change Order accordingly.
    b. If a quantity greater than the assumed quantity of excess import is required, the Contractor shall perform this work at the unit price stated in his bid and the contract will be increased by Change Order accordingly.

3. All import required for fill required to achieve final grades and completed structures as defined in the Contract Documents, shall be included in the basic bid and shall not be compensated using unit prices.

C. Unauthorized Excavation and Import: The Contractor shall be responsible for all un-authorized excavation. The unit price shall not be applied to un-authorized excavation. The owner is not responsible for un-authorized over excavation nor the import required to replace any unauthorized excavation unless approved by the Geotechnical Engineer.

D. Sub Grade: For the purpose of the Contractor Bid, the following shall define the sub-grade elevations:

1. Footings: The elevation of the bottom of the footing or the bottom of excavation shown on C1.10, whichever is lower.
2. Buildings: The elevation at the bottom of the capillary break or the bottom of excavation as shown, whichever is lower.
3. Walkways and Paving: The elevation at the bottom of the paving section.
4. Utility Trenches: The elevation of the bottom of the pipe bedding.
5. Landscaped Areas: The elevation below the stripping depth or the soil planting section, whichever is lower.

E. Soil integrity will be influenced by the weather conditions and the Contractor's handling and protection of the material as it is removed and placed. It is the sole responsibility of the Contractor to protect soils from the elements. Material that is deemed unsuitable due to lack of protection will not be applied to the unit price. The Contractor will be responsible for removing such material and replacing with acceptable material at no additional cost to the owner.

F. The Contractor shall not apply the Unit Price noted in Section 012200 to material that was not defined as unsuitable material by the Geotechnical Engineer.

1.8 QUALITY ASSURANCE

A. Comply with applicable provisions of the following specifications and documents:

1. WSDOT Standard Specifications Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.
2. City of Lakewood Engineering Standards.
3. ASTM D1556-90 Test Method for Density of Soil in Place by the Sand-Cone Method.
4. ASTM C136 Standard Method for Sieve Analysis of Fine and Course Aggregate.
5. ASTM D-422 -90 Method for Particle Size Analysis of Soils
6. ASTM D1557-91 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/cu ft).
7. ASTM D2922-91 Standard Test methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

8. ASTM D3017-88 Standard Test methods for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
9. ASTM D698-91 Standard Test method for Moisture-Density relations of soils and soil-aggregate mixture using 5.5-lb. Rammer and 12-inch Drop.
10. ANSI/ASTM D1557-78 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-pound Rammer and 18-inch Drop.
11. AASHTO T176 Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test.
12. ASTM D3017-78 Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

B. Contractor Qualifications

1. Crew Foreman: Minimum six years' working experience and four years' experience as foreman performing similar work.

C. Regulatory Requirements

1. All work and material shall be in accordance with WSDOT Standard Specification.
2. City of Lakewood Engineering Standards as indicated above.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Stockpiling: Stockpile materials on site within clearing limits and at locations approved by Architect. The contractor shall be responsible for protecting the stockpiled material.

B. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

C. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

D. Comply with WSDOT Section 3-02.2(6). Contractor shall provide survey stakes for stockpiles.

E. Maintain toe of material at least 6 feet from edges of trenches and excavations. Pile so surface water is prevented from flowing into excavations. Provide free access to fire hydrants, water valves, meters; private driveways; and leave clearance to enable the free flow of storm water in gutters, conduits, and natural water courses.

1.10 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Expose, excavate, and place existing site material only in dry weather.

B. Existing Conditions: Existing on-site material is moisture sensitive and moisture content is above optimum for compacting.

1.11 SEQUENCING AND SCHEDULING

A. Maintain drainage in areas of site to be occupied during construction.

B. Schedule work in this section to coordinate with the existing buildings abandonment and demolition and proposed building construction schedule.

1.12 DIMENSIONS AND LAYOUTS

A. Refer to Section 311000 “Site Preparation”.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Utility Trench Backfill:

1. Landscaped areas: shall be Gravel Borrow in accordance with WSDOT 9-03.14(1).
2. Paved Areas: shall consist of Gravel Borrow in accordance with WSDOT 9-03.14(1) and WSDOT 9-03.9(3), “Crushed Surfacing Base or Top Course” per standard details.

B. Pipe Bedding Material:

1. Bedding material for rigid pipes shall be in accordance with WSDOT 9-03.12(3).
2. Bedding material for flexible pipes shall be in accordance with WSDOT 9-03.9(3) with the exception of flexible sewer pipe, which shall be per WSDOT 9-03.12(3).

C. Gravel Backfill for Drains: shall be 1-inch minus washed rock in accordance with WSDOT 9-03.12(4), “Gravel Backfill for Drains”. It shall be free of roots, organic matter, and other unsuitable materials; have less than 2 percent by dry weight passing the No. 200 sieve (washed analysis) and have at least (2) mechanically fractured faces.

D. Gravel Backfill for Walls: shall consist of select granular material in accordance with WSDOT 9-03.12(2), “Gravel Backfill for Walls”.

E. Foundation Gravel: Foundation Gravel shall meet the requirements for Gravel Backfill for Foundations Class A, Section 9-03.12(1)A of the Standard Specifications.

F. Crushed Surfacing Top Course: shall be manufactured from ledge rock, talus or gravel and shall be 5/8" minus for top course. Crushed surfacing top course shall conform to the gradations of Section 9-03.9(3) of the Standard Specification.

G. Crushed Surfacing Base Course: shall be manufactured from ledge rock, talus or gravel and shall be 1 1/4" minus for base course. Crushed surfacing base course shall conform to the gradations of Section 9-03.9(3) of the Standard Specification with the following

revisions: the material passing the No. 200 sieve shall be 5.0% (maximum), and it shall have at least two mechanically fractured surfaces.

H. Capillary Break: shall consist of clean, washed rock such as pea gravel or "Gravel Backfill for Drains".

I. Drain Rock shall be "Gravel Backfilll for Walls".

J. Structural Fill: All fill placed under footings, slab-on-grade floor, roadways, sidewalks, walkways, and all other paved areas shall be "structural fill" as defined herein, unless specified otherwise for particular applications.

1. Existing, unconsolidated fill excavated on site may be used for structural fill. Native fill used for structural material shall be free of deleterious materials, moisture conditioned, placed, compacted, and covered during the wet season. The use of native material shall be subject to review and approval by the geotechnical engineer.
2. Structural fill may be imported materials from an approved quarry that conforms to the grading requirements of Gravel Borrow, Section 9-03.14(1) of the Standard Specifications, with the exception of the material passing the #200 sieve shall be less than 5%.
3. Structural fill below the "Ground Level" Foundations shall be Controlled Density Fill, as shown on sheets C1.01 and C1.10.

K. Common Fill: All fill placed under landscaped and vegetated areas to specified subgrade elevations shall be "common fill" as defined herein, unless specified otherwise for particular applications. Common Fill shall be granular material, either naturally occurring or processed. It shall be essentially free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact readily. The maximum particle size shall not exceed 6 inches. On-site Common Fill shall conform to APWA Section 9-03.14(3) except that the percent by weight passing the U.S. No. 200 sieve shall be based on the portion passing the ¾ inch sieve. Imported Common Fill shall conform to the requirements of on-site Common Fill except that the percent by weight passing the U.S. No. 200 sieve shall not exceed 5 percent based on the portion passing the ¾ inch sieve.

L. Controlled Density Fill (CDF): shall be a mixture of Portland Cement, admixture (optional), Fly Ash, aggregates and water. It shall be proportioned to provide a grouty, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength.

1. Materials testing shall be with unconfined compressive test cylinders. Test data may be either laboratory trial batch test data or field test data.
2. Alternate mix designs may be required at the Engineer's discretion.
3. The unconfined compressive strength at 28 days shall be a minimum of 50 psi and a maximum of 100 psi. Material shall be a sand/grout slurry proportioned to be hand-excavatable after long term strength gain.

4. The material consistency shall be flowable (approx. slump 3-10”). If requested by the Contractor, the proportions may be adjusted with the approval of the Engineer.
5. Materials shall meet the requirements of the following sections of the Standard Specifications:

   a. Portland Cement 9-01
   b. Fine Aggregate for Portland Cement Concrete 9-03.1(2)
   c. Admixture for Concrete 9-23.6
   d. Fly Ash 9-23.9
   e. Water 9-25

6. CDF shall meet the following requirements:

Ingredients	**Amount per Cu. Yd.**
Portland Cement	50 lb.
Aggregates Class 1 or 2	3,300 lb.
Air Entrainment Admixture	Per Manufacturer’s recommendation
Fly Ash Class F	300 lb.
Water	300 lb. (maximum)

M. Filter Fabric:

1. Stabilization Geo-fabric shall be a woven geotextile conforming to WSDOT 9.33(2)1, Table 3, “Soil Stabilization”.
2. Separation Geo-fabric shall be a non-woven geotextile conforming to WSDOT 9.33(2)1, Table 3, “Separation”.

N. Tracer Tape

1. Utility pipe tracer tape shall be detectable below ground surface, color coded, with utility name printed on tape. Conductive warning tape required over all sewer, drainage, water, and irrigation pipe. Tape shall be manufacturer's standard permanent, bright-colored, continuous printed plastic tape, aluminum backed, intended for direct-burial service. Tape shall be not less than 6" wide x 4 mils thick.

2. Tape Schedule:

Piping	Color	Text
Domestic Water	Blue	Caution Domestic Water
Storm Sewer	Green	Caution Storm Sewer
Sanitary Sewer	Green	Caution Sanitary Sewer

2.2 APPROVAL OF FILL MATERIAL

A. All fill placed under footings, slab-on-grade floor, asphalt paving, sidewalks, walkways, and other paved areas shall be "Structural Fill" as defined herein, unless specified otherwise for particular applications.

B. Approvals of fill material: All material that is proposed to be used as fill and backfill shall be graded and tested for moisture content. Gradation and test results shall be submitted for review and approved by the Geotechnical Engineer or Testing Agency prior to placement.

C. It is the sole responsibility of the Contractor to protect existing ground, prepared subgrade, and any stock piled material from inclement weather, surface runoff, construction traffic and other conditions that may preclude the re-use of the material.

2.3 RECYCLED MATERIAL

A. The contractor may use Recycled Hot Mix Asphalt or Recycled Concrete as, or blended uniformly with, naturally occurring minerals or aggregates. The final blended product shall meet the requirements for the specified type of aggregate. Recycled materials must meet chemical, gradation distribution requirements, and performance criteria of the substituted or augmented material. Specifically, the final blended product shall contain a maximum recycled material content conforming to the following specifications:

1. Recycled Hot Mix Asphalt - Section 9-03.21(2)
2. Recycled Concrete - Section 9-03.21(3)

B. Recycled material is not allowed as backfill for utility trenches or building foundations.

C. Existing asphalt may be milled in place with the underlying gravel base and be reused as fill beneath paved areas. No other applications for recycled asphalt will be allowed.

D. Recycled Glass is not allowed for this project.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspection: Provide sieve analysis per ASTM D422 for each material type. Tests and analysis of aggregate material will be performed in accordance with WSDOT Standard Specifications. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify as follows:

1. Verify survey benchmark and intended elevations for the work are as indicated.
2. Verify vegetation to remain is protected and prominently marked.
3. Verify erosion control is in place and operating properly.
4. Verify removal of abandoned utilities is complete.

3.2 PREPARATION

A. Protection:
1. Locate existing utilities, avoid damage or disturbance. For aid in utility location call "Dial Dig 1-800-424-5555," 48 hours (two working days) prior to beginning construction. Provide and pay for additional marking as required.
2. Protect and maintain existing utilities which are to remain.
3. Identify existing structural foundations near excavations. Verify excavation will not undermine footings or supports and cause damage to structures.
4. Protect plant life, lawns, and other features remaining as a portion of final landscaping or interim erosion control.
5. Protect benchmarks, existing structures, sidewalks, railings, paving, and curbs.
6. Protect pavement or paved areas intended to remain from damage.
7. Use all means necessary to prevent the erosion of freshly graded areas during construction or until such time that permanent drainage and erosion control measures are fully operational.
8. Protect existing buildings scheduled for demolition but still occupied by the owner during work performed under this section.
9. Repair and/or repair of damaged facilities will be accomplished at the Contractor’s expense.

B. Survey and stake limits of clearing per City of Lakewood Standards.

C. Identify required lines, levels, contours, and datum. Should indicated figures conflict with actual conditions, notify Architect and await direction before proceeding.

D. Identify onsite trees to be removed within limits of clearing.

E. Verify existing grade elevations to be matched. Notify Architect where existing grades to be matched creates an adverse affect, such as blocking grading, abrupt change in grade, slopes steeper than allowed, and grades not conforming with ADA.

3.3 CONSTRUCTION

A. Clearing and Grubbing (Stripping) shall be in accordance with Section 2-01.3 of the Standard Specifications.

1. Refer to Section 311000 “Site Preparation”.
2. Strip topsoil, organics, loose silty fine sands, and soft surficial soils to a depth of 12 inches below existing grade within the limits of clearing.
3. Do not strip more area than can be protected from moisture damage to underlying material.
4. Remove and dispose of debris.

B. Subgrade Preparation

1. Shall be in accordance with Section 2-06 of the Standard Specifications.

2. Following stripping and site excavation, and prior to placement of any backfill, proof roll exposed subgrade of proposed buildings, slabs and paved areas with appropriate construction equipment approved by the Architect. At least three passes of the equipment shall be made over the exposed subgrade. In areas where pumping or excessive subgrade movement occurs, remove and replace existing material with Structural Fill as required by the geotechnical engineer.
3. Minimize traffic over prepared subgrade.

C. Grading

1. Shape subgrades to lines, grades, and cross sections indicated on the Plans; remove and replace soft or otherwise unsatisfactory material; excavate rock encountered to a depth of 6 inches below finish subgrade elevations; bring low areas up to required elevations with Structural fill.
2. Grade areas adjacent to building and structures in a manner that provides positive drainage away from structures and prevents ponding at the building or structure, itself.

D. Stabilization of Excavations and Trenches shall be per Section 7-08.3(1) of the Standard Specifications.

1. The Contractor shall exercise sound engineering and construction practices for excavations and trenches and maintaining them so that no damage will occur to any foundation, structure, pole line, pipe line, or other facility because of sloughs or slopes, or from any other cause. If, as a result of the excavation or trenching, there is disturbance of the ground, which may endanger other property or require repair, the Contractor shall take remedial action at no expense to the owner.
2. The Contractor shall provide dewatering, shoring or other types of stabilization, in addition to the shoring required for safety by State codes, as required to maintain the integrity of the trench or excavation and protect nearby existing utilities and structures. All earthwork shall conform to the Washington Administrative Code (WAC) 296-155 requirements for Excavation, Trenching, and Shoring. If the Contractor elects to provide stabilization by open pit excavation or flatter side slopes, no additional compensation will be made for the work including excavation, select backfill material, backfilling, and protection of existing facilities.

E. Cutting and Filling

1. Fill areas to contours and elevations with approved Structural Fill.
2. Place and compact fill materials in continuous layers not exceeding 8 inches loose depth.
3. Maintain optimum moisture content of fill materials to attain required compaction density.
4. Do not fill over ponded surface water or existing subgrade surfaces which are yielding, disturbed, or softened.
5. Suspend placing fill when the climatic conditions will not allow proper placement and fill compaction.

6. Make grade changes gradual. Blend slope into level areas. Construct uniform grades between spot elevations or contours shown.
7. Fill slopes shall be overbuilt by 12 inches and then trimmed back to the required slope to maintain a firm face.
8. Remove surplus fill materials from site, at no additional expense to the Owner, to an approved waste site.

F. Backfill and Compaction

1. All areas that are to receive compacted fill shall be field reviewed by the Testing Agency prior to the placement of new fill.
2. Following the clearing, stripping, excavations to grade and any required over-excavation, and before placement of any structural fill, the exposed subgrade under all areas to be occupied by paving, soil supported slabs, or spread footings shall be proof rolled or compacted to a dense and unyielding condition with a loaded dump truck, large vibrating roller or equivalent.
3. Site clearing, proof rolling, and compaction efforts shall be observed by testing agency or Geotechnical engineer. Any areas of loose or soft soil exhibiting significant deflection, pumping, or weaving that cannot be adequately reworked and/or compacted shall be over-excavated per the Geotechnical recommendations. Over excavated material shall be replaced with Structural Fill.
4. Soil surfaces that will receive compacted fill shall be scarified to depth of at least six inches. The scarified soil shall be moisture-conditioned to obtain soil moisture within 3% of optimum moisture content. The scarified soil shall be compacted to a minimum relative compaction as listed in this Section.
5. Relative compaction is defined as the ratio of the in-place soil dry density to the maximum dry density as determined by the ASTM D1557 test method.
6. Place fill in controlled layers the thickness of which is compatible with the type of compaction equipment used. The loose thickness of each fill layer shall not exceed eight (8) inches if using heavy equipment and four (4) inches if using hand-operated equipment. Compact each layer to a minimum relative compaction as listed in this Section. Determine the field density of compacted soils by the ASTM D2922 and D3017 test method or equivalent.

    a. The loose thickness for fill within 3 feet of the back of retaining walls shall be six (6) inch lifts or less and shall use hand-operated tamping equipment.

7. Fill soils shall be granular and shall meet the gradation requirements stated herein. The Testing Agency shall evaluate and/or test proposed material for its conformance with specifications prior to delivery to the site. The Contractor shall notify the Testing Agency 72 hours prior to importing fill to the site.
8. The Testing Agency shall observe the placement of compacted fills and conduct in-place field density tests on the compacted fill to check for adequate moisture content and the required relative compaction. Where less than the required relative compaction is indicated, remove and replace the substandard soil or apply additional compactive effort and moisture-condition the soil as necessary until the relative compaction as specified in this Section is attained. Provide level testing pads for the conducting of field density test by the Testing Agency.

9. Compaction Requirements: Compact all fill and backfill to prevent subsequent settlement. Water-settling or jetting is not permitted as a means of compaction. Furnish heavy rollers or compactors except as follows:

    a. Use pneumatic hand tampers for trenches and areas not accessible to heavy equipment.
    b. Compact areas within 5' of footings, foundations and within 3’ of walls with hand vibrators.

10. Conditioning existing soil to reduce moisture: Condition existing material to within 3 percent of optimum moisture content for compacting. If moisture level is above optimum then aerate to dry and reduce moisture. Process may include placing thinner lifts and allowing material to dry, blading turning, and disking material, or other methods approved by Geotechnical Engineer.
11. Required compaction: Compact fill and backfill to the following minimum relative compaction (percentage of maximum dry density determined in accordance with ASTM D1557):

Locations	Required Minimum Relative Compaction
Under slabs on grade	95%
Under walks and paving	95%
Bedding for utility lines	95%
Against walls (within 3 feet)	90%
Against footings and foundations	90%
Planting and landscape areas	90% (see Section 329000 for additional information)
Other	90%

The top two feet of structural fill behind walls shall be compacted to 95% in areas where slabs or pavement will be constructed.

G. Infiltration system subgrade preparation

1. Do not compact the infiltration subgrade established at the base of planned excavation as shown on the Engineering Plans.
2. Excavation equipment shall be limited to tracked excavator working at arm's length to minimize disturbance and compaction of infiltration surface.
3. Rubber-tired equipment shall not be allowed on vault subgrade in bottom of vault.
4. Exposed soil at bottom of vault excavation shall be reviewed by owner's geotechnical engineer to confirm that soil conditions are consistent with soils encountered during geotechnical investigation.
5. Completion of the infiltration facility may require over-excavation of fill soils and glacial till below the facility bottom elevation. The geotechnical engineer must be present to observe excavation of the facility bottom and any over-excavation beyond the design depths.
6. The contractor must provide samples of each backfill material to geotechnical engineer a minimum of one week before the material is delivered to the site for

grain size testing. Geotechnical engineer reserves the right to collect additional samples throughout the duration of construction for grain size testing to compare to the gradations specified for the project.

7. Contaminated backfill materials will be rejected.

H. Small-scale (pilot) confirmation infiltration testing shall be performed at time of construction to confirm the design infiltration rate. This testing shall be performed prior to any backfill of the excavation or installation of storage pipes.

1. The geotechnical engineer will conduct the testing.
2. The contractor shall provide water for the testing. The water source must be either a minimum 4,000-gallon water truck and water tank (for continuous flow over many hours) or fire hose from a hydrant.
3. Duration of testing will be the majority of one work day per test. The number of tests will be determined by geotechnical engineer based on substrate conditions observed at time of excavation.

3.4 SITE TOLERANCES

A. Grading Tolerance: Finish grades shall match contours and elevations shown within 1/10 foot.

3.5 FIELD QUALITY CONTROL

A. Field Quality Control shall be in accordance with Section 01400 Quality Control.

B. Site Tests: Perform compaction test. If tests indicate Work does not meet specified requirements, re-compact and retest at Contractors Expense.

C. Inspection

1. Subgrade prior to placing fills
2. Surface after completion of cuts and fills and prior to placing top soil, bases, or pavements.

3.6 PROTECTION

A. Protection of Surfaces:

1. If subgrade or fill soils become loosened or disturbed, additional excavation to expose undisturbed soil and replacement with properly compacted fill will be required. The Contractor may reduce disturbance by the following methods:

a. Limit construction traffic over unprotected soil.
b. Provide gravel “working mats”
c. Sloping excavated surfaces to promote runoff. Collecting runoff and directing it to the sediment storage facility.

d. Sealing exposed surfaces by rolling with a smooth drum compactor or rubber tired roller at the end of each working day and removing wet surface soil prior to filling each day.

2. The Contractor shall repair and provide the additional excavation, disposal, and import of replacement material at no additional cost to the owner.

3.7 CLEANING

A. Dispose of waste, surplus, and unsuitable materials according to laws, regulations, and ordinances off site at a site obtained by Contractor.

3.8 WET WEATHER WORK

A. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when control of soil moisture content is not possible, the following recommendations should be followed.

B.

1. Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic.
2. The ground surface within the construction area should be graded to promote runoff of surface water and to prevent the ponding of water.
3. Material used as structural fill should consist of clean granular soil containing less than 5 percent fines. The fines should be non-plastic.
4. The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials at no additional cost to the owner.
5. Excavation and placement of fill should be observed by the Geotechnical Engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and bales of straw and/or geotextile silt fences should be strategically located to control erosion.

END OF SECTION 312000

SECTION 321200 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplemental Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Section Includes: Asphalt concrete pavement including base courses as described herein and in drawings.

B. Related Section: Coordinate work with related work specified in other parts of the Specifications, including but not limited to the following:

1. Section 013323 “Submittal Procedures”
2. Section 015700 “Erosion Control”
3. Section 321200 “Earth Moving”

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction herein referred to as the Standard Specifications
2. Pierce County Engineering Design and Construction Standards (2009)
3. Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report for Proposed Western State Hospital Commissary and Kitchen Building, by Associated Earth Sciences, Inc. dated January 14, 2010

1.4 SUBMITTALS

A. General: Submit in accordance with Section 013323 “Submittal Procedures”.

B. Asphalt Mix: Submit proposed job-mix formula for the bituminous mixture, or certificate showing compliance with specifications.

C. Certificates: Submit manufacturer's certification that concrete mix, bituminous materials, aggregate base and herbicide comply with specification requirements; include laboratory, compaction, and slump test reports verifying compliance, if requested.

1.5 SUSTAINABILITY CRITERIA

A. WSSP Submittals: Refer to Specification Section 013553A for additional requirements and submittals.

1. Product Data for Credits M2.1: For products having recycled content, documentation indicating percentages by weight of post-consumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit M2.5: List of proposed regional materials and regionally extracted and manufactured materials. Identify each regionally manufactured material, including quantity in the project, it source, cost, and the fraction by weight that is considered regional.

1.7 QUALITY ASSURANCE

A. Dimensions and Layout shall be in conformance with Section 321100 “Site Preparation”.

B. Qualifications: Work is subject to the following qualifications.

1. Producer/Installer: Provide materials produced by bulk asphalt concrete producer regularly engaged in the production of hot-mix, hot-laid asphalt concrete. Installer must be experienced in the installation of Asphaltic concrete paving with adequate plant, equipment, and personnel for the completion of the work.
2. Materials: Provide fresh new materials meeting or exceeding requirements specified herein.

C. Allowable Tolerances: Surface Smoothness shall be in accordance with Section 5-04.3(13) of the Standard Specifications

D. Testing:

1. Contractor will furnish material testing and inspection for quality control during paving operations. Paving thickness is subject to core tests upon completion. Should average thickness be less than specified, apply more paving to furnish specified thickness as a minimum. Patch all core drill holes.
2. Pavement shall be tested for proper thickness and proper drainage as specified in Section 014000.

1.8 PROJECT SITE

A. Existing Conditions: Where paving interferes with the completion of the Work, cut out and dispose of at Contractor's expense. Upon completion of the Work, patch all such damaged pavement to match adjacent existing paving.

B. Environmental Conditions: Apply asphalt concrete surface course only when atmospheric temperature is more than 45-deg. F., when underlying base is dry, and when weather is not rainy or damp. Aggregate base course material may be applied when air temperature is not below 30-deg. F. and rising, if approved by Architect.

C. Environmental Conditions: Do no work when base or earth sub-grade is wet or contains an excess amount of moisture.

D. Protection & Controls:

1. Grade Control: Establish and maintain the required lines and grades, including crown and cross slopes, for each course of paving until completion and acceptance of the Work.
2. Traffic Control: Maintain vehicular and pedestrian traffic lanes during paving operations as required for other construction activities and for access to the existing building and facilities. The Contractor shall be responsible for the protection of the new paving against vehicular traffic prior to and for a minimum of 48 hours following any required seal coat operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Headers, Benders & Stakes: Construction Grade Douglas fir; preservative treated.

B. Base Materials for Asphalt Concrete Paving: See Specification 312000 “Earth Moving” for Crushed Surfacing Top and Base Course materials.

C. Hot Mix Asphalt ("HMA"):

1. Shall be 1/2-inch HMA in accordance with Section 9-03.8 of the Standard Specifications.
2. Asphalt Binder shall be viscosity grade AR-4000, PG 58-22.

D. Crack Filler: Flexafil rubberized asphalt, or equal.

E. Other Materials: Provide all accessory and incidental materials, equipment, tools, and methods required for completion of paving where indicated on drawings, including the following:

1. Seal Coat: The Seal Coat shall be Armor Seal or Approved Equal. Seal coat shall form a ductile, wear resistant, and skid resistant surface. It shall be water tight and provide a smooth, uniformly colored seal to pavement.
2. Tack Coat: CSS-1 in accordance with Standard Specification, Paragraph 9-02.1(6). Apply to all vertical surfaces to which "ACP" abuts including existing asphalt at all saw cuts.

PART 3 - EXECUTION

3.1 ASPHALT PAVING INSTALLATION

A. General: Remove all existing fill, debris, vegetation, and other perishable materials from areas to be paved. Proof-roll subgrade and address soft yielding areas per Geotechnical Engineers recommendation. Bring areas requiring fills to rough grade elevations. Install wood headers and benders to true lines as indicated and securely staked to prevent movement or displacement during paving operations. Remove upon completion.

B. Base Course: Place in accordance with the requirements of WSDOT Standard Specification Section 4-04 and to the thickness shown on the plan or to match existing depth, whichever is greater. Materials shall be graded and compacted in 4-inch maximum layers to at least 98 percent of maximum density in accordance with ASTM D1557, Method D.

C. Asphalt Concrete Paving: Provide Hot Mix Asphalt as indicated on the plans, consisting of mineral aggregate, uniformly mixed with bituminous material in a central plant. Provide all labor, equipment and materials required to complete the work. All asphalt concrete pavement work shall conform to the requirements of WSDOT Standard Specification, Paragraph 5-04.3.

D. Place asphalt in accordance with Section 5-04 of WSDOT-APWA. Spread, finish and compact in accordance with Sections 5-04.3(9) and 5-04.3(10). Minimum lift thickness shall be 1 ½ inches.

E. Construct joints shall be in accordance with Section 5-04.3(12). Provide surface smoothness in accordance with Section 5-04.3(13). Accomplish paving in accordance with the weather limitations outlined in Section 5-04.3(16).

F. Sample and test asphalt concrete in accordance with Sections 5-04.3(8)A and 5-04.3(12).

G. The completed surface of the wearing course shall not vary more than 1/4 inch in 10 feet from the rate of slope shown in project plans. Depressions exceeding 1/4" shall be corrected.

H. Tack Coat: All contact surfaces, curbs and cold pavement joints shall be painted with asphalt emulsion before the surfacing is laid. All longitudinal and transverse joints shall be fully compressed by the spreading machine and be free from surface irregularities.

I. Seal Coat: Shall be per Manufacture’s recommendations.

3.2 ASPHALT PAVEMENT PATCHING

A. Patching Bituminous Pavement: Replace the existing pavement with asphalt concrete pavement and compacted aggregate base course to either match the existing thickness as the existing asphalt paving and base course or the asphalt paving section as shown on the plans, whichever is greater.

END OF SECTION 321200

SECTION 321300 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplemental Conditions and Division 01 Specification Sections, apply to this section.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 01 57 00 “Erosion Control”
2. Section 01 33 23 “Submittal Procedures”
3. Section 31 20 00 “Earth Moving”

1.2 SUMMARY

A. This section Includes:

1. Exterior walks and slabs as indicated on the Drawings.
2. Provide surface preparation form work, form removal and clean-up.
3. Included herein is any exterior concrete flat work including walks, stairs, and curbs.
4. Provide poured in place concrete curbs in parking areas and other areas as shown.

1.3 REFERENCES:

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction (Standard Specifications)
2. Standard Plans: WSDOT/APWA Standard Plans for Road, Bridge, and Municipal Construction

1.4 SUBMITTALS

A. General: Comply with Section 013323 “Submittal Procedures”

B. Certificates: Submit manufacturer's certification that concrete mix and aggregate base comply with specification requirements; include laboratory, compaction, and slump test reports verifying compliance, if requested.

1.5 SUSTAINABILITY CRITERIA

A. WSSP Submittals: Refer to Specification Section 013553A for additional requirements and submittals.

1. Product Data for Credits M2.1: For products having recycled content, documentation indicating percentages by weight of post-consumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit M2.5: List of proposed regional materials and regionally extracted and manufactured materials. Identify each regionally manufactured material, including quantity in the project, it source, cost, and the fraction by weight that is considered regional.

1.6 QUALITY ASSURANCE

A. Standard Concrete: Provide at least one person who shall be present at all times during the execution of this portion of the work who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this section.

B. Codes and Standards: Comply with the current standards of the local jurisdiction having authority. Comply with all requirements of APWA manual, Current Edition.

C. Concrete Testing: Comply with testing requirements of Section 033000.

D. Protection: Use all means necessary to protect curb, walk and slab materials before, during and after installation. Protect the installed work and materials of all other trades.

E. Replacements: In the event of damage, repair or replace walks and slabs to the satisfaction of the Architect at no additional cost to the owner.

F. Materials: Provide fresh new materials meeting or exceeding requirements specified herein.

G. Allowable Tolerances: Surface Smoothness shall be in accordance with Section 5-05.3(12) of the Standard Specifications

H. Testing: Contractor will furnish material testing and inspection for quality control during paving operations. Paving thickness is subject to core tests upon completion as specified in Division 01. Should average thickness be less than specified, apply more paving to furnish specified thickness as a minimum. Patch all core drill holes.

I. Attend pre-installation meeting at project site prior to start of work.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Provide wood edge forms, Douglas Fir and Larch, number two grade minimum, seasoned, SAS, straight and true.

B. Special edge forms for radii shall be approved in advance by the Architect.

2.2 CONCRETE

A. Portland Cement shall be Type I/II Concrete Pavement per Section 9-01.2(1) of the Standard Specifications.

B. Standard Concrete Paving shall be 3000 P.S.I., air-entrained, minimum 5-3/4 edge sacks per yard. Slump to be 4" maximum. Maximum aggregate size: 3/4". This spec to be used for concrete curbs, also.

2.3 JOINTS

A. Expansion Joints: Extend joint-filler full width of joint and to 1/4" of finished concrete surface. Premolded asphalt saturated felt 3/8" thick. Seal with approved high quality, weather tight, flexible joint sealant per Section 9-4.1(2) of the Standard Specifications.

B. Tool or Control score joints shall not exceed intervals as shown on drawings. On straight work, the joints shall be parallel with and at right angles to the line of the work. The markings shall be made by hand tooling creating rounded edges at the scoring line with a radius of ½-inch and with a depth of not less than shown in the Plans.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection: Prior to all work of this Section, inspect work of other trades to verify that such work is complete to a point where walk and slab installation may properly commence.

B. Verify that curbs, walks and slabs may be placed in accordance with the original design.

C. Discrepancies: In the event of discrepancy, immediately notify the Architect.

D. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 SURFACE PREPARATION

A. Prepare subgrade for pouring of concrete per Sections 311000 "Site Preparation" and 312000 "Earth Moving" to address soft yielding areas per Engineer's recommendation.

B. Standard Concrete Paving: Provide minor excavation and hand preparation required for placement of crushed rock base course. Remove all organic materials, fill all voids, compact soft spots and other soils disturbed by excavation to 95% maximum soil density.

Dampen soil to 100% maximum moisture content. Place sub slab sand, modified proctor method, to depths shown on drawings compact to 95%.

3.3 DIMENSIONS AND LAYOUTS

A. See Section 311000, “Site Preparation”

B. Contractor shall replace existing concrete paving to match the existing location. Note all locations of existing score joints and expansion joints and install new score and expansion joints to match existing.

3.4 STANDARD CONCRETE PAVING INSTALLATION

A. Concrete Walks shall be installed per Section 8-14.3 of the Standard Specifications.

B. Provide Portland cement concrete from a WSDOT approved ready-mix plant. Provide all labor, equipment and materials required to complete the work. All Portland cement concrete work shall conform to Section 5-05.3 of the Standard Specifications.

C. Form vertical surfaces to full depth and securely position to required lines and levels. Ensure form ties are placed as required to prevent form bowing, and to ensure that ties do not pass through concrete.

D. Construct joints in accordance with Standard Specifications Section 5-05.3(8).

1. Tool joints are to be ¼-inch minimum dimension, formed with a V-tool and placed per the Contract Documents.
2. Tool edges of formed joints to a maximum 1/8-inch radius.

E. Provide surface smoothness in accordance with Standard Specifications Section 5-05.3(12). Accomplish paving in accordance with the weather limitations outlined in Standard Specifications Section 5-05.3(14).

F. Base Course: Place in accordance with the requirements of Section 4-04 of the Standard Specification and to the thickness shown on the plan or to match existing depth, whichever is greater. Materials shall be graded and compacted in 4-inch maximum layers to at least 95 percent of maximum density in accordance with ASTM D1557, Method D. During concrete placement, keep base sufficiently moist to prevent excessive absorption of water from freshly placed concrete.

3.5 STANDARD CONCRETE TESTING

A. Sample and test Portland cement concrete in accordance with Standard Specifications Sections 5-05.3(3)E and 5-05.3(4).

B. The completed surface of all Portland cement concrete shall not vary more than 1/8 inch in 10 feet from the rate of slope shown in project plans. Variations exceeding 1/4" shall be corrected at the Contractor’s sole expense.

3.6 STANDARD CONCRETE FINISHES:

A. All exposed concrete pavement surfaces shall have a medium broom finish, in parallel, linear patterns, perpendicular to the principal direction of travel and parallel to joints or edges of walk.

B. Provide all curbs with a smooth finish.

3.7 CONCRETE CURB INSTALLATION

A. Install all concrete curbing to the line and grade indicated in the Documents. Installation shall be in conformance with Standard Specification Section 8-04.3. Vertical curbs shall be installed using formwork that is supported in the center and does not deflect. Any curb faces showing "bowing" or other deformation shall be removed and replaced at the Contractor's expense. Match sidewalk joint locations where adjacent.

3.8 FINISH TOLERANCES

A. Finish all walks and slabs to plus or minus 0.05 feet at any point from line and grade shown on the Drawings.

B. Slope walks to drain as shown on the Drawings. Walks less than 8'-0" wide shall be sloped at 1.8% in the width direction of the walk or as shown on drawings. Slope all walks to drain away from the building.

3.9 REPAIR/REPLACEMENT

A. Repair or replace to owner's satisfaction any curbs or walks placement or finish is found to be defective or non-conforming. Replace all work damaged by contractor's operations.

END OF SECTION 32 13 00

SECTION 321723- PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section specifies the work necessary for painting Pavement Markings on the finished pavement at locations as shown on the drawings.

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. Washington State Department of Transportation (WSDOT)/American Public Works Association 2010 Standard Specifications for Road, Bridge, and Municipal Construction
2. Manual On Uniform Traffic Control Devices (MUTCD) as currently adopted by the State Department of Transportation.
3. Federal Specification TT-P-115, Traffic Paint

1.4 SUBMITTALS

A. General: Comply with Section 013323 “Submittal Procedures”

B. Certificates: Submit manufacturer's certification that pavement markings comply with specification requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Paint shall be white, traffic paint (or compound suitable for paved surfaces), for parking stalls, cross walks, and block-out areas conforming to the requirements of Federal Specification TT-P-85E Type I and Type II. Paint shall be lead free.

B. Paint shall be delivered and stored in sealed containers that plainly show the designated name, formulation, or specification number, batch number, color, date of manufacture,

manufacturer's name, formulation number and directions, all of which shall be printed legibly at time of use. The paint shall be homogeneous, easily stirred to a smooth consistency, and shall show no hard settlement or other objectionable characteristics.

C. Paint for pavement marking shall conform to Federal Specification TT-P-115, color: white, yellow, red.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall furnish and experienced technician to supervise the location, alignment, layout, dimensions, and applications of pavement markings.

B. All surfaces to be marked shall be thoroughly cleaned before application of the paint. Dust, dirt and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of the methods as required. Rubber deposits, surface laitance, and other coating adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals or mechanical abrasion as directed.

C. Paint Application: Two applications of paint will be required to complete all paint markings. Apply paint evenly to the pavement surface to be coated at the rate of 105, plus or minus 5, square feet per gallon. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 40 degrees F and less than 95 degrees. Maintain paint temperature within these same limits. Apply paint pneumatically with approved equipment.

D. Provide guide lines and templates as necessary to control paint application. Take special precautions in marking letters and symbols. Sharply outline edges of marking. The maximum drying time requirement of the paint specifications shall be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the marking, until cause of the slow drying is determined and corrected.

E. Parking Areas:

1. Parking stall striping shall be 4 inches wide painted white unless otherwise noted on the plans.
2. Lane striping shall be 8 inches wide painted white unless otherwise noted on the plans.
3. Stop Bar and Handicapped Parking Stall Symbol shall be in accordance with Section 8-22 of WSDOT/APWA.
4. Text shall be white paint.

F. Fire Lane Striping:

1. Fire lane access roads shall be marked with curbs painted red along the entire top and side faces of the curb, as indicated on the plans.

2. Mark/stencil the face side of the curb with 6-inch white lettering to read “FIRE LANE-NO PARKING”, at 50-foot intervals.

G. Paint shall be applied uniformly at a rate specified in Section 8-22 of the standard specification. All markings shall be protected from traffic until the paint is thoroughly dry. All markings shall present a clean cut, uniform, and workmanlike appearance. All marking which fail to have a uniform, satisfactory appearance shall be corrected by the Contractor at his expense.

H. Cleaning: Leave premises clean and free of residue of work of this Section.

END OF SECTION 321723

SECTION 328000 - SPRINKLER IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Conform to the General Conditions, Supplementary Conditions and Division 1.

1.02 DESCRIPTION OF WORK

A. Installation: This sprinkler irrigation system shall be installed only by a licensed and bonded landscape contracting firm that specializes and has extensive experience in the installation of sprinkler irrigation systems.

B. Work Included: Furnish all labor and materials to install the sprinkler irrigation system complete as shown on the plans and herein specified. The work includes furnishing and installing all meters, pipe, fittings, valves, sprinkler and shrubbery heads, backflow preventor and other appurtenances shown on the drawings, and performing of all labor for connections to existing water sources or other pressure lines installed by others as indicated on the drawings and specifications. Contractor shall supply and install all equipment shown on the plans and indicated in the specifications to achieve proper operation of the said equipment. All equipment installations shall be in conformity with all applicable codes and ordinances, these specifications, and the manufacturers recommendations whether indicated on the drawings or not.

1.03 SUBMITTALS

A. List of Materials: Submit to the Landscape Architect, two copies of a complete list of all materials proposed for use on this project. The list shall give, for each item, the name of the manufacturer, trade name, and catalog date, specifications, brochures, or other data giving complete information about each item proposed for use. The Landscape Architect will determine the equality of the material, equipment, or method, and the Landscape Architect's decision will be final. If the Contractor installs as specified, catalog data or brochures will not be required.

B. Items completely identified in the Specifications and Drawings by catalog numbers, trade names, and model numbers, and which the Contractor proposes to furnish therewith, may be listed "as specified" without further description. Quantities of material and equipment need not be included since these are the Contractor's responsibility.

1.4 PRODUCT HANDLING

A. Damage to Property: Any structures or facilities damaged due to work of this project shall be restored equal to their original condition at the Contractor's expense.

B. The Contractor shall be responsible for all damage to any part of the premises caused by leaks, or breaks in pipe or equipment furnished or installed by him/her under this project, for a period of one year after date of acceptance of the contract.

C. Clean-up: Upon completion of the work, clean up all boxes, wrappings, excess materials, equipment and other rubbish resulting from this work and leave the premises in a clean, neat and orderly condition.

1.5 JOB CONDITIONS

A. Disruption of Services: Permission to shut off any water lines must be obtained in writing from the Owner's Representative who will make the necessary arrangements. Disruptions shall be kept to a minimum.

B. Testing: The Contractor shall not allow or cause any of the work installed by him to be covered before it has been inspected and approved. Work covered before approval shall be uncovered at Contractor's expense.

PART 2 - MATERIALS

2.1 PIPES

A. All pipes shall be new of standard weight for its class and of virgin components. All pipes shall be continuously and permanently marked with manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F., and National Sanitation Foundation (NSF) approved.

2.2 GALVANIZED STEEL PIPE AND FITTINGS

A. All galvanized steel pipe shall be Schedule 40, hot-dip galvanized, conforming to ASTM A120-76. Fittings shall be malleable iron, hot dip galvanized.2.03

2.3 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. PVC pipe and fitting shall be polyvinyl chloride compound Type 1, Grade 1 or Type 1, Grade 2 conforming to ASTM D 1784 specifications. The pipe and fittings shall be approved and certified by the National Sanitation Foundation. Pipe and fittings shall be free from defects in materials, workmanship and handling.

B. PVC solvent weld pipe shall be of PVC 1120, PVC 1220, or Schedule 40 material, and shall be 200 psi minimum pressure rating with SDR 21 walls which conforms to ASTM D 2241.

C. PVC threaded pipe shall be of the same material and shall be Schedule 80 which conforms to ASTM D 1785. Pipe fittings shall conform to ASTM D 2466, Type 1, Grades 1 or 2.

2.4 GATE VALVES/BALL VALVES

A. Gate valves and ball valves, when called for on the plans, shall be heavy-duty bronze or brass conforming to the requirements of ASTM B 62. Valves shall be of the same size as the pipes on which they are placed and shall have union or flange connections. Service rating shall be 150 psi minimum. Gate valves shall be of the double disk, taper seat type,

with non-rising stem, union bonnet, and hand wheel. Valves shall be installed with unions as specified on the plans or details.

2.5 VALVE BOXES

A. Valve boxes over control valves, gate valves, etc., shall be Ametek or equal 12" meter boxes with green covers in lawn or ground cover areas. In paved areas or at curb, install concrete valve boxes by Brooks No. 9, or Fraser Boxes with extension. Valve box covers shall have bolt down covers. Refer to plans.

2.6 BACKFLOW PREVENTION DEVICE

A. See drawings for manufacturer and model numbers. Install per local plumbing codes.

2.7 AUTOMATIC CONTROLLERS

A. Automatic Controller(s) shall be in a sturdy weatherproof and rustproof housing with security lock as designated on drawing. Controller shall be of the numbered stations and model designated, or if an equivalent model, approval must be requested in writing. Installation of wiring shall be in the manner directed on the drawing, by the manufacturer, and in conformance to National Electrical Code and local codes governing. The installer shall leave in the housing all instructions pertaining to operations and a chart designating stations by number in the same manner that appears on drawing.

2.8 AUTOMATIC CONTROL VALVES

A. Automatic remote control valves shall be globe or angle pattern with flanged or screwed connections as required. Screwed valves shall be provided with union connections.

B. Valves shall be of a "normally closed" design and shall be electric solenoid operated, having maximum rating of 6.5 watts utilizing 24 volt power. Solenoids shall be directly attached to the valve bonnets or body with all control parts completely internal. A manual control bleed cock shall be included on the valve to operate the valve without the requirement of electric current. A manual shutoff stem with cross handle for wrench operation is required for manual adjustment from fully closed to wide open.

2.9 MANUAL DRAIN VALVES

A. Manual valves shall be bronze or brass, angle type with hex brass union. Service rating shall not be less than 150 psi non-shock cold water. Valves shall be designed for underground installation with suitable cross wheel for operation with a standard key. The Contractor shall furnish two suitable operating keys. Valves shall have removable bonnet and stem assembly. Valve discs shall be full floating with replaceable seat washers.

2.10 ELECTRICAL WIRE

A. Electrical wire used between the automatic controller and automatic valves shall be solid copper AWG No. 14 minimum size, Type USE Cross Linked Polyethylene or TW. Type UF, and shall be color coded or marked with number identification.

2.11 QUICK COUPLING VALVES

A. Valves, couplers and hose swivels shall be of one manufacturer and of the size and model number specified on the drawings. Valves shall be 3/4" bronze or brass. Furnish three quick coupling couplers and three hose swivels to Owner.

2.12 SPRINKLERS

A. All sprinklers shall be of the type specified on the drawings or approved equal.

B. Sprinklers shall be installed as per construction details.

2.13 MISCELLANEOUS EQUIPMENT

A. Miscellaneous Equipment and Components not specifically indicated, but normally included in the work performed shall be furnished and installed by the Contractor.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Location of pipe, sprinkler heads, valves, and other equipment shall be as shown on the plans and shall be of the size and type indicated. No changes shall be made except as approved by the Landscape Architect.

B. Water and electrical service connections shall be made by the Contractor as indicated in the plans. Such installations and equipment shall conform to the requirements set forth by the supplying utility and local codes.

3.2 LAYOUT

A. The Contractor shall stake the sprinkler irrigation system following the schematic design shown on the plans before the construction begins. Alterations and changes in the layout may be expected in order to conform to the ground conditions and to obtain full and adequate coverage of water. It is understood that corrective measures in the system may become necessary but no changes or alterations in the system as planned shall be made without the prior authorization of the Landscape Architect.

3.3 EXCAVATIONS

A. Excavations shall be open vertical construction sufficiently wide to provide free working space around the work installed to provide ample space for backfilling and tamping.

B. Trenches for pipe shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.

C. When two pipes are to be placed in the same trench, it is required to maintain a 2 inch space between pipes as a minimum.

D. Pipes under paved areas shall be bedded in 6 inches of clean sand all around pipe(s).

E. Minimum depth of cover for pipe lines shall be as follows:

1. Main lines and lateral lines under paved areas, 24 inches.
2. Main lines and quick coupling lines, 18 inches.
3. Lateral lines to sprinklers, 12 inches.

3.4 PLASTIC PIPE LINES

A. PVC pipe, indicated herein, shall be installed for all pressure supply lines including quick coupling valves.

B. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.

C. Plastic pipe shall be cut with a hand saw or hacksaw in a manner so as to insure square ends. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

3.5 SOLVENT WELD JOINTS

A. Contractor shall use only the solvent supplied and recommended by the manufacturer to make plastic pipe joints. All connections shall be made as per manufacturer's recommendations for solvent-welding pipe.

B. All solvent weld joints shall be first primed with p-70 (purple) PVC primer or approved equal.

C. The pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture before applying solvent.

3.6 PIPE CONNECTION

A. The Contractor is cautioned to exercise care in handling, loading and unloading, and storing plastic pipe and fittings. All plastic pipe and fittings will be stored under cover before using, and will be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subject to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded until said section pipe is cut out and rejoined with a coupling.

B. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into position in the trench, and it shall be kept clean by approved means during and after laying of pipe.

C. All threaded pipe connections shall be made using Teflon tape wrapped at least three times around pipe threads.

3.7 DRAIN VALVES

A. It shall be the Contractor's responsibility to establish the locations of the drain valves during installation and to insure complete drainage of all water mains and laterals. Each

drain valve shall be placed in a drain pit which shall be constructed in accordance with the details.

3.8 INSTALLATION OF AUTOMATIC CONTROLLER, VALVES AND SPRINKLERS

A. The automatic controller shall be securely installed where shown on drawings. Furnish and install metallic conduit of size to accommodate properly the number of 24 volt wires required to pass through it, from the controller unit to the existing conduits. Junction boxes shall be furnished and installed as required to allow pulling of wires to controller. New conduits from buildings shall exit walls at 6" above finish grade.

B. The completed controller installation shall be level, neat, sturdy, and to the complete satisfaction of the Owner.

C. Label all zones on chart inside controller door as to area locations with plastic label tape.

D. The remote control valves shall be installed as shown.

E. Wiring may be installed in the same trench as the water pipe.

F. Sharp bends or kinks in the wiring shall not be permitted. Wires shall be unreeled in place alongside or in the trench, and shall be carefully placed along the bottom of the trench. Under no condition shall the cable be unreeled and pulled into the trench from one end.

G. Where two or more cables are laid parallel in the same trench, they shall be taped together not less than every 25 feet. Splices shall be limited to the areas under the valve boxes.

H. The splices shall be made with Pentite by Rainbird, or approved equal. Neatly coil two (2) feet of cable slack at each RCV solenoid connection within access boxes.

I. Not less than one (1) foot of cable slack shall be left on each side of all splices. The slack cable shall be placed in the trench in a series of "S" curves.

J. Installation of sprinkler heads shall be as detailed.

3.9 BACKFILLING AND FLUSHING

A. The procedure for backfilling shall be the same for trenches with pipe only, conductor only, or both pipe and conductor only, or conduit and conductor.

B. Because of the expansion and contraction of the plastic pipe, backfilling shall be done in the cool part of the day. In areas where trenches are not in contact with imported topsoil, backfill with clean sand only.

C. All lumber, rubbish, and rocks over 1" in size shall be removed from the trenches. Pipe shall have firm, uniform bearing from the entire length of each pipe line to prevent uneven settlement. Wedging or blocking of pipe will not be permitted.

D. After the pipe and/or wires have been installed, the trench shall be backfilled with clean topsoil; where upon the soil shall be settled with clean water and regraded as needed. If clean topsoil is not available, imported clean sand shall be used.

E. Extreme care shall be exercised by the Contractor while backfilling. Any materials or equipment damaged or destroyed while backfilling shall be repaired or replaced by the Contractor as directed by the Owner at no cost to the Owner.

F. Contractor shall correct any subsequent settlement of trench, to the satisfaction of, and at no cost to the Owner.

G. Flushing: Before the trench has been backfilled, all water pipe installed shall be flushed clear and clean of all dirt and foreign material.

3.10 TESTING

A. After flushing, the pipe shall then be submitted to a leakage test. All tests on pressure lines shall be completed prior to backfilling. Soil shall be placed in trenches between fittings to insure the stability of the line under pressure. In all cases, fittings and couplings must be open to visual inspection for the full period of the test. No testing shall be done until the last solvent welded joint has had twenty-four (24) hours to set and cure. All main lines shall be subject to a 2 hour pressure test at a minimum continuous pressure of 150 PSI. A maximum pressure drop of five (5) PSI will be allowed.

B. All control valves shall be closed. The sprinkler system main shall be slowly filled with water to line pressure.

C. Before testing, all air shall be expelled from the pipes.

D. Where any section of the pipe system is provided with a concrete thrust block, the test shall not be made until at least five (5) days have passed after the concrete thrust block was installed. If higher early strength cement is used in the concrete thrust block, the test shall not be made until at least two (2) days have elapsed.

E. Should any section of pipe laid disclose leakage, locate and repair defective pipe or joint and retest.

PART 4 - RECORD DRAWINGS AND GUARANTEE

4.1 ADJUSTING SYSTEM

A. Before final inspection, the Contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual sprinkler heads with the adjustment screws or replacing heads to produce a uniform pattern.

B. Sprinkler spray patterns will not be permitted on pavement, walks, or structures.

4.2 AS BUILT PLANS AND SYSTEM ORIENTATION

A. Contractor shall maintain a set of drawings on the site specifically for recording changes as they occur during the job. All changes shall be current to within 24 hours of said change. Upon completion of work, Landscape Architect shall provide the Contractor with a set of reproducible drawings on which to make any changes, diagrams, or other drawings modifications necessary to show the actual location of the installed system. Actual locations for all equipment and mainlines shall be indicated by field-verified dimensions. These drawings shall be neatly drafted and clearly legible. They shall be resubmitted to Landscape Architect upon their completion. The Contractor shall conduct a training and orientation session covering the operation, adjustment, and maintenance of the irrigation system. The Contractor shall provide the Owner with parts lists and service manuals for all equipment. Contractor shall be responsible for one fall winterization and one spring activation of the sprinkler system and shall conduct these operations as part of the Owner's training and orientation procedures.

4.3 GUARANTEE

A. The Contractor shall provide a written guarantee to the Owner covering all materials, installation, workmanship, and against defects for a period of one (1) year. Contractor shall be responsible for maintaining system and protecting it from all damage (at no cost to Owner) for the duration of the specified maintenance period. This shall include damage caused by vandalism or adverse weather conditions. Upon completion of maintenance period and final inspection, the Contractor's guarantee will apply barring these two factors.

END OF SECTION 32 80 00

SECTION 329030 – HYDROSEEDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Conform to the General Conditions, Supplementary Conditions and Division 1.

1.2 SCOPE OF WORK

A. Hydroseeding shall occur on all areas shown and those areas outside clearing limits disturbed by construction.

1.3 PLANTING SEASON

A. Hydroseeding shall be done between August 15 and September 30 or between March 15 and May 15. In areas receiving automatic irrigation, hydroseeding may occur between May 15 and August 15.

B. Actual planting shall be performed only when weather and soil conditions are suitable and in accordance with locally accepted practice and/or approved by the Landscape Architect. Hydroseeding shall not be attempted when wind velocities would prevent uniform application or when winds would drift the material outside the areas to be seeded.

1.4 APPLICATION QUALIFICATION

A. Hydroseeding shall be performed by an experienced applicator.

1.5 GUARANTEE

A. The guarantee of all lawn areas under this contract shall be for one full year from the completion date of final acceptance. Although not responsible for maintenance of the lawn during the guarantee period, the Contractor should, for his/her own interest, assure themselves that minimum care is being given to the lawn as they are liable for its health during the guarantee period. At the conclusion of the guarantee period, the Landscape Architect will make another inspection to determine the condition of lawns.

B. All areas of lawn not in a healthy growing condition, as determined by the Landscape Architect, shall be reseeded with seed as originally planted. Such replacement shall be made in the same manner as specified from the original plantings, and at no extra cost to the Owner. The guarantee on lawns shall be limited to one replacement. The Contractor is not responsible for vandalism.

PART 2 - PRODUCTS

2.1 SEED SPECIFICATION

A. STANDARD SEED MIX (Percentage by Weight)

Hard Fescue (Aurora II)	20%
Perennial Turf Type Rye Grass (Manhattan 5, Silver Dollar)	60%
Kentucky Bluegrass (Midnight II, Prosperity)	20%

The above seed mixture shall be applied at the rate of 240 pounds per acre.

B. NATIVE VEGETATION SEED MIX (Percentage by Weight) as available from Sunmark Seeds International 1.888.214.7333, Troutdale, OR or approved equal

Festuca idahoensis - *Idaho Fescue*	45%
Stonehenge Hard Fescue	45%
Native Wild Flower Seed – See below	10%

(Combination of 4 or more)
- Dodecatheon jefferii - *Mountain Shooting Star*
- Camassia quamash bio cascades - *Blue Camas*
- Viola nuttallii - *Yellow Prairie Violet*
- Viola adunca - *Western Long Spurred Violet*
- Collinsia parviflora bio Cascades - *Blue Eyed Mary*
- Balsamorhiza sagittata - *Arrowleaf Balsamroot*

The above mixture shall be applied at the minimum rate of 12 lb. per 1000 s.f. or as suggested by seed supplier.

C. ANALYSIS – Contractor shall provide a complete analysis of the seed prior to planting, include the percent of pure seed, germination, other crop seed, inert and weed seed, and the germination test date to the Landscape Architect. All crop seed more than one percent must be itemized.

D. SEED LAW - All seeds shall conform to the requirements of the Washington State Seed Law and, where applicable, the Federal Seed Act.

E. NOXIOUS WEED SEED - All seed shall be free of seeds listed as primary noxious by the Washington State Seed Law. Seeds shall not contain seeds of weeds listed as secondary noxious by the Washington State Seed Law, singly or collectively in excess of the labeling tolerance specified by the Washington State Seed Law.

F. REJECTION - When seeds furnished under this specification fail to meet the requirements within tolerance as provided by the Washington State Seed Law, the lot shall be rejected.

G. PREPARATION FOR DELIVERY - Seeds shall be packed in clean, dry, solid containers of uniform weight. Seed shall be labeled as required by law.

2.0 FERTILIZER

A. Commercial fertilization mix 10-20-20 applied at the rate of 10 pounds per 1000 s.f.

2.3 WATER

A. Water shall be free from oil, acid, alkali, salt and other substances harmful to growth of grass, and shall be from a source approved prior to use.

2.4 WOOD-CELLULOSE FIBER MULCH

A. Wood-cellulose fiber mulch for use with hydraulic application of grass seed and fertilizer shall consist of specially prepared wood-cellulose fiber processed to contain no growth - no germination - inhibiting factors and dyed an appropriate color to facilitate visual metering of application of materials. Apply the least amount of mulch possible no greater than a rate of 1,200 pounds per acre.

2.5 SOIL STABILIZER

A. Soil stabilizer shall be capable of penetrating soil surface and binding soil particles; shall contain an adhesive to hold seed and wood-cellulose fibers together and bond them to the soil; and shall be made from naturally occurring and biodegradable materials. Apply soil stabilizer at the rate of 50 pounds per acre.

PART 3 - EXECUTION

3.1 PREPARATION OF GROUND SURFACES

A. Contractor shall fine grade all areas prior to hydroseeding. Verify with Landscape Architect prior to seeding. Refer to plant section 329000 for those areas to receive additional preparation.

B. Remove all stones and debris over 1 inch in diameter.

C. Cultivate ground surfaces and grade smooth.

D. Compact lightly to eliminate all soft spots, hills, and valleys.

E. Finish grade shall be ½" below all adjoining curbs, roads, walks and other paved surfaces.

3.2 HYDROSEEDING

A. Seed shall be broadcast with approved hydraulic seeding equipment, in combination with wood-cellulose fiber mulch, soil stabilizer and fertilizer distributed uniformly over designated areas. Half of seed shall be sown with sower moving in one direction, the other half with sower moving at right angles to first sowing. Seed shall not be broadcast

during windy weather. Hydroseed operator shall remove all seed mulch in its entirety from adjoining paving, structures, and plants.

3.3 SEEDING PROCEEDURE FOR NATIVE VEGETAITION AREA

A. Seed shall not be placed until soils have stabilized and further settlement is not apparent. Utilize irrigation system for consolidation of top mix.

B. Apply Seed with a mechanical seeding machine such as a Brillion Drill.

C. Seed at a minimum rate of 12 lbs. per 1,000 square feet. Sow one-half of the seed in two separate applications in a 90-degree crossing pattern.

D. Germination and plants survival: In the event there is a lack of germination or failure of plant survival to achieve a uniform, complete cover of turf plants, the Contractor is to immediately reseed at specified rates the effected areas as soon as the condition is detected.

3.4 INSPECTION

A. Areas not fully germinated with a uniform stand of grass or areas damaged through any other cause shall be reseeded as herein specified at the Contractor's expense.

3.5 RESEEDING

A. For reseeding ‘Fleur de Lawn Mix’ shall be applied at the rate of 44 pounds per acre (1 lb. per 1000 s.f.) Sow one-half of the seed in two separate applications in a 90-degree crossing pattern utilizing a drop type seeder.

B. Fertilize with 3-1-2 mix ratio all areas failing to show an uniform stand of grass after germination of seed, or damage through any cause before final inspection as specified by the Contractor at no additional cost to the Owner.

3.6 MEASUREMENT AND PAYMENT

A. The lump sum contract amount for the contract item “Landscaping” shall include all compensation for providing the labor, equipment and materials necessary to perform the work as indicated on the plans, and specified herein, for all of the materials including but not limited to: soil stabilizers, fertilizer, mulch and seed.

B. The lump sum contract amount for the contract item “Landscaping” shall be full compensation to furnish, install and maintain all the hydroseeding as shown on the plans and specified herein.

END OF SECTION 329030

SECTION 329100 – LANDSCAPE INSTALLATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Conform to the General Conditions, Supplementary Conditions and Division 1.

1.2 DESCRIPTION OF WORK

A. Contractor shall coordinate all activities necessary for the provision of all labor, materials, tools, equipment, services, trees, shrubs, and ground covers necessary to complete all landscape operations in accordance with these specifications, as shown on the plans and details, or as directed by the Landscape Architect/Owner.

B. These landscape operations shall be performed only by a licensed, bonded landscape contracting firm that specializes in landscape installation.

C. Trees, shrubs, and ground covers will hereinafter be referred to collectively as plant material.

1.3 PRESERVATION OF PROPERTY

A. The planting operations shall be conducted in such manner that no damage shall result to existing site improvements and plantings. The Contractor shall be responsible for any damage resulting from his operation, and shall repair or replace such damage at his own expense by qualified trades and/or installers acceptable to the Owner.

1.4 JOB CONDITIONS

A. Planting operations including soil preparation, shall proceed only during periods, which are normal for work as determined by season, weather conditions, and accepted practice. Do not perform work when there is prolonged freezing weather, or when the soil is in a wet or muddy condition.

B. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Any utilities, structures, or other facilities damaged due to work on this project shall be restored, equal to their original condition at the Contractor's expense.

C. When conditions detrimental to plant growth are encountered, such as rubble, rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect/Owner before planting.

1.5 PRODUCT HANDLING & TEMPORARY STORAGE

A. Handling and shipping of plant material shall be done in a manner that is not detrimental to the plants. Plant material shall be packed for shipment in accordance with prevailing practice for the type of plant being shipped. All plants shall be protected against drying,

sun, wind, heat, freezing, and similar detrimental conditions at all times. When necessary, plant material shall be temporarily healed in.

B. Protect work by placing stakes and twine barrier (visible day or night) around any planted area if required as a barrier for pedestrians, animals, vehicles, or any other cause until acceptance of work.

C. Plant materials showing damage from shipping, or while in storage, or during planting shall be rejected by the Landscape Architect/owner and be replaced by the Contractor at his own expense.

1.6 SUBSTITUTION OF PLANTS

A. No substitution of plant material will be permitted unless evidence is submitted to the Landscape Architect that a specified plant or variety cannot be obtained. If substitution is permitted, it can be made only with the approval of the Landscape Architect/Owner.

PART 2 - MATERIALS

2.1 PLANT MATERIALS:

A. All plant material furnished shall meet the grades established by the American Standard Nursery Stock (ANSI Z60.1). Each shall conform to the size and acceptable conditions as listed on the plans and shall be free of all foreign plant material. An exception to this standard shall concern tree caliper measurements. All tree calipers shall be sized at 'ANSI' (American National Standards Institute) height, which shall be considered to be 6" above the top of the root-ball.

B. All plant material shall consist of live woody or herbaceous materials that are vigorous, well formed, with a well-developed fibrous root system. The material shall be free from dead branches, lichens, and from damage caused by an absence or an excess of heat or moisture, insects, disease, mechanical, or other causes detrimental to good plant development.

C. Deciduous trees shall have solitary leaders (unless indicated otherwise on plan) and shall have only lateral branches thinned by pruning. All conifer trees shall have only one leader (growing apex) and one terminal bud. Trees having a damaged or missing leader, multiple leaders, or Y-crotches shall be rejected.

D. Root-balls of the evergreen plants shall be solidly held together by the fibrous root system of the plant in its natural position and shall be composed only of the earth in which the plant has been actually growing.

E. Container grown plants must be plants transplanted into a container and grown in that container sufficiently long for new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from container.

F. Landscape Architect/Owner reserves the right to inspect all plant material at place of growth for compliance with requirements for size, variety, condition, including disease,

and if rootbound. This preliminary approval does not constitute final approval of plants at completion of installation operations.

2.2 SEED:

A. Grass seed of the type specified shall conform to the standards for "Certified" grade seed or better as outlined by the State of Washington Department of Agriculture "Rules for Seed Certification", latest edition. Seed shall be furnished in standard containers on which shall be shown the following information:

1. Common name of seed
2. Lot number
3. Net weight
4. Percentage of purity
5. Percentage of germination (in case of legumes, percentage of germination to include hard seed)
6. Percentage of weed seed content and inert material clearly marked for each kind of seed in accordance with applicable State and Federal Laws.

B. Upon request, the Contractor shall furnish to the Landscape Architect duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within 6 months before date of delivery on the project. Seed which has become wet, moldy, or otherwise damaged in transit, or storage will not be accepted.

2.3 GROUND COVER

A. Provide plants established and well-rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed.

2.4 TOPSOIL

A. Imported topsoil for berming and other required sub-grade work shall be a friable sandy loam typical of topsoils cultivated locally. Topsoil shall be free of objectionable subsoil materials, weeds, noxious weed seeds, refuse, sticks, brush, and rocks larger than 1" across the greatest dimension. Topsoil shall contain no more than 10% rocks or gravel by volume.

2.5 FERTILIZER:

A. Fertilizer for backfill mix and soil preparation shall be standard commercial grade of organic or inorganic fertilizer of the kind and quality specified herein. It may be separate or in a mixture containing percentage of total nitrogen, available phosphoric acid, and soluble potash in the amounts specified. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with State and Federal Laws.

B. Commercial fertilizer shall have the following guaranteed chemical analysis:

Percentage

Ingredient	*Minimum*	*Maximum*
Nitrogen	10	16
Phosphoric Acid	10	16
Water Soluble Potash	5	16

C. Top dress fertilizer shall be applied on the surface of all plant pits after installation and shall be Osmocote 18-6-12, 9 month slow release applied at the following rates;

Trees Over 10' Height	2 Cups
Trees Under 10' Height	1 Cup
All Shrubs Except 1 Gallons	½ Cup
All 1 Gallon Plants	¼ Cup
All Ground Covers	¼ Cup

D. Fertilizer tablets for plant material shall be a nitrogen-phosphorus-potassium ratio similar to 20-10-5. The nitrogen shall be derived from urea formaldehyde and shall be supplied in a two year controlled release 21 gram or 10 gram size table. Tablets shall be manufactured by "Agriform" or equal.

E. Apply fertilizer tablets in the following quantities per plant:

2 ¼" pots and 4" pots	1-10 gram tablet
1 gallon container	1-21 gram tablet
All shrubs	3-21 gram tablets
All trees	1 tablet per ½" tree caliper. (min. 4-21 gram tablets)

F. Where more than 1 tablet is required, they shall be evenly spaced around the plant, directly next to the rootball.

2.6 BED MULCH TOP DRESSING

A. Bed mulch top dressing for all shrub and ground cover areas shall be Ground Fir & Hemlock bark of uniform color, free from weeds, seeds, sawdust, splinters, resin, tannin, wood fiber, salts, or other compounds detrimental to plant like. Size range shall be ¼" to 1" with a maximum of 50% passing a ½" screen. Submit sample to Landscape Architect for approval.

2.7 SOIL AMENDMENT

A. Soil amendment for soil preparation and use in soil mix shall be nitrified wood residual product, composted at 130° to 160° for four (4) and six (6) months and screened to 1/2" minus in size. Soil amendment shall be equal to the following compost brands as available from: (Submit sample for approval to landscape architect.)

1. Top Grade Compost as available from Silver Springs Organics, Rainier, WA (360) 446-7645
2. Cedar Grove Compost as available from Cedar Grove Compost, Maple Valley, WA (877) 764-5748

3. PREP/LRI Compost as available from Randles Sand and Gravel, Inc., Puyallup, WA (253) 537-6828

2.8 SOIL MIX

A. Soil mix for planters and backfill mix shall consist of the following by volume:

60% screened clean loamy sand
40% specified soil amendment

B. Submit sample of soil mix to Landscape Architect for approval prior to use on project. No rocks or gravel shall be allowed in soil mix.

2.9 PREPARED BACKFILL MIX

A. For all plant materials (except Rhododendrons & Azaleas) shall consist of the following per cubic yard (Submit sample for approval to landscape architect):

1/3 c.y. clean site soil
2/3 c.y. specified soil mix
4 c.f. bagged Canadian shredded peat moss
3 lbs. specified commercial fertilizer
3 lbs. single superphosphate
1 lb. iron sulfate

B. Backfill mix for Rhododendrons & Azaleas shall consist of 2/3 above specified backfill mix and 1/3 fine grind hem-fir bark mulch. (Submit sample for approval to landscape architect)

C. Prepared backfill mix shall be thoroughly blended and mixed in an area adjacent to the planting work, and shall be accurately proportioned using a suitable container. Unused site soil excavated from plant pits shall be disposed of off-site. Protect backfill mix from moisture until it has been placed in backfill around plants.

2.10 CHEMICAL HERBICIDE

A. A weed control pre-emergent herbicide which is approved for ornamental nursery stock and approved by the Landscape Architect/Owner. Application of herbicide must be in compliance with all local and state codes and laws. Do not use Casaron or Norasac brands. Apply at conclusion of specified maintenance period. Verify compatibility of herbicide with landscape plant materials.

2.11 SPECIFIED MATERIALS

A. Contractor is required to keep all labels, bags, and other containers for all fertilizers, chemical soil amendments, pre-emergents, herbicides and other chemicals until approved by the Landscape Architect as proof that specified materials and quantities have been used. Failure to do so shall result in additional amendments required to meet these specifications and be verified by the Landscape Architect.

2.12 STAKES & GUYING

A. Stakes and guys shall be installed as shown on Plans.

2.13 ROOT BARRIER

A. Root Barrier Panel EP-2450 by NDS, or approved equal, shall be installed at the edge of all walks, paving or curb within 8 ft. of the tree trunk. Root barrier shall be installed at a minimum of 8' feet in both directions from the center of trunk.

PART 3 - EXECUTION

3.1 LAYOUT OF PLANTING

A. All location layout and staking will be the responsibility of the Contractor, subject to the approval of the Landscape Architect.

B. The Contractor shall place the plants starting from the perimeter of the bed area and progressing to the center of any planting bed as shown on the plans and details.

C. Tree locations shown on the plans shall be considered approximate unless shown with specific distance. Tree locations shall be adjusted so that the tree is not directly in front of sprinkler heads.

D. Plant material quantities shown on the plans are approximate and for reference only. The Contractor is responsible for determining the exact number of plants required to place all plants at the spacing indicated, and to verify those indicated quantities with plan drawings.

3.2 PLANT BED PREPARATION

A. All planting areas shall be prepared so that they remain weed and debris free until the time of final acceptance. The planting areas shall include all planting beds and those areas shown on the plans or directed by the Landscape Architect/Owner.

B. Preparation of all planting areas shall be undertaken as indicated on the plans and shall include the following:

1. Kill and remove existing weeds and vegetation except as directed by Landscape Architect or indicated otherwise on plans.
2. Remove all debris, including asphalt, stumps, rocks, and clods from all planting surfaces.
3. Scarify and cultivate existing compacted subgrades in proposed landscape beds prior to any grading operations.
4. Supply specified topsoil and soil amendment to depths indicated on plans, in specifications, and in details. All landscape areas shall receive topsoil, whether indicated on the plans or not, so that finish grades after soil preparation and bed mulch application shall conform to final grading requirements listed in the following paragraphs.

3.3 FINISH GRADING

A. SURFACES: All planting surfaces shall be left with a firm, uniform surface, free of undulations or other irregularities. Remove all rocks, clods, and debris from all planting surfaces. Finish grade of all non-turf areas shall be 2" below tops of adjacent pavements and curbs, unless indicated otherwise on plans.

B. PRELIMINARY GRADING: Shall be done in such a manner as to anticipate the finished grade. Excess soil shall be removed or redistributed before application of soil mix, fertilizer, and mulch. Where soil is to be replaced by plants and mulch, allowance shall be made so that when finish grading has begun, there shall be no deficiency in the specified depth of mulched planting beds.

C. FINAL GRADING AND DRAINAGE: The Contractor shall bear final responsibility for proper surface drainage of the site and the features thereon. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party which the Contractor feels precludes establishing proper drainage, shall be brought to the attention of the Landscape Architect in writing for correction or relief of said responsibility.

D. STRUCTURAL FILL AREAS: Any landscape areas occurring within structural fill zones shall have said structural fill materials excavated to a depth of 12” below finish grades in shrub beds and 6” below finish grades in lawn areas, and replaced with specified topsoil. Dispose of excavated materials off site.

3.4 SOIL PREPARATION (All Planting Areas)

A. All areas on the plan to receive soil preparation shall first be cultivated to a light and friable consistency, where upon the following ingredients, per 1000 s.f., shall be uniformly tilled into the top 6"-8" of soil, using a rototiller or similar machine, and then thoroughly watered down:

54 c.y. 60/40 mix topsoil (18" average depth)
15 lbs. commercial fertilizer
15 lbs. iron sulfate
10 lbs. triple superphosphate (0-45-0)
100 lbs. agricultural gypsum

B. All soil preparation and planting operations shall be conducted under favorable weather conditions only. Soil shall not be worked when excessively dry or wet. Landscape Architect reserves the right to stop any work taking place during a period when conditions are considered detrimental to soil structure or plant growth. Fine grade as specified above.

C. All planting beds shall be approved by Landscape Architect before rototilling (with soil amendments distributed over surface of bed) and after rototilling has been completed. All beds shall be approved for fine grading before planting operations.

3.5 SOIL PREPARATION (All Hydroseed lawn Areas)

A. Procedural operations shall be the same for items A through C in paragraph 3.04 above, except for soil amendments.

B. Soil amendments shall consist of the following per 1,000 square feet:

14 c.y. 60/40 mix topsoil (4" average depth)
100 lbs. dolomite lime
100 lbs. agricultural gypsum
15 lbs. commercial fertilizer

C. Finish grade shall be ½" below all adjoining paved surfaces.

D. Refer to Section 329219 specifications if hydro-seeding is required.

3.6 SOIL PREPARATION (All Native Vegetation Areas)

A. Procedural operations shall be the same for items A through C in paragraph 3.04 above, except for soil amendments.

B. Soil amendments shall consist of the following per 1,000 square feet:

14 c.y. compost (4" average depth)

C. Finish grade shall be ½" below all adjoining paved surfaces.

D. Refer to Section 329219 specifications if hydro-seeding is required.

3.7 ORDER OF PLANTING

A. In mixed planting areas, trees shall be planted first, followed by the larger shrubs, low shrubs, and then ground covers.

3.8 PLANTING (TREES AND SHRUBS)

A. Planting shall be done only when conditions favorable for planting exist. Under no circumstances will planting during freezing weather or in frozen ground be permitted.

1. Plants shall not be placed in any areas that are below the finished grade as shown on the plans or as directed by the Landscape Architect.
2. Planting shall be performed in accordance with the details shown on the plans and in accordance with most suitable techniques.

B. Before excavation, plants to be installed shall be placed as indicated on planting plan. The Landscape Architect shall check locations of all plants in the field and shall indicate the exact position before actual planting operation proceeds.

C. Set trees and shrubs in center of pits, plumb and straight. Except in lawn areas, plant at such a level that after settlement, the crown of the plant will be flush with finish grading and forming a shallow trough directly over the ball of the earth and slightly smaller than the pit to facilitate watering.

D. Set plants in backfill mixture to such depth that the top of the plant ball will be flush with finished grade. Backfill the remainder of the hole and soak thoroughly. Water the backfill

until saturated to the full depth of the hole. Pour Top Dress fertilizer over the surface of plant basin at indicated rates. Water all plants immediately with liquid Alaska Fish Fertilizer at manufacturer's suggested rates. Keep empty containers per paragraph 2.12. Install fertilizer tablets as specified.

E. A mound of earth shall be formed as directed around each tree and shrub so as to produce a shallow basin to retain water, the diameter to exceed the diameter of the root spread. Plants shall be watered in place during and after backfilling. Trees planted in lawn areas shall receive no watering basins, but shall be centered in a 3’-0" diameter circle mulched with bed mulch.

F. Prune plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Pruning to be done under supervision of Landscape Architect. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools. Paint cuts over 3/4" diameter, covering exposed areas with tree paint.

G. Immediately after planting operations are complete, all beds and pits shall be dressed off so as to achieve a neat and presentable appearance.

H. Planting operations shall be identical for all plants to be transplanted. Refer to plans and directions from Landscape Architect.

3.9 ORDER OF PLANTING

A. In mixed planting areas, trees shall be planted first, followed by the larger shrubs, low shrubs, and then ground covers.

3.10 PLANTING (TREES AND SHRUBS)

C. Planting shall be done only when conditions favorable for planting exist. Under no circumstances will planting during freezing weather or in frozen ground be permitted.

3. Plants shall not be placed in any areas that are below the finished grade as shown on the plans or as directed by the Landscape Architect.
4. Planting shall be performed in accordance with the details shown on the plans and in accordance with most suitable techniques.

D. Before excavation, plants to be installed shall be placed as indicated on planting plan. The Landscape Architect shall check locations of all plants in the field and shall indicate the exact position before actual planting operation proceeds.

I. Set trees and shrubs in center of pits, plumb and straight. Except in lawn areas, plant at such a level that after settlement, the crown of the plant will be flush with finish grading and forming a shallow trough directly over the ball of the earth and slightly smaller than the pit to facilitate watering.

J. Set plants in backfill mixture to such depth that the top of the plant ball will be flush with finished grade. Backfill the remainder of the hole and soak thoroughly. Water the backfill until saturated to the full depth of the hole. Pour Top Dress fertilizer over the surface of

plant basin at indicated rates. Water all plants immediately with liquid Alaska Fish Fertilizer at manufacturer's suggested rates. Keep empty containers per paragraph 2.12. Install fertilizer tablets as specified.

K. A mound of earth shall be formed as directed around each tree and shrub so as to produce a shallow basin to retain water, the diameter to exceed the diameter of the root spread. Plants shall be watered in place during and after backfilling. Trees planted in lawn areas shall receive no watering basins, but shall be centered in a 3'-0" diameter circle mulched with bed mulch.

L. Prune plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Pruning to be done under supervision of Landscape Architect. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools. Paint cuts over 3/4" diameter, covering exposed areas with tree paint.

M. Immediately after planting operations are complete, all beds and pits shall be dressed off so as to achieve a neat and presentable appearance.

N. Planting operations shall be identical for all plants to be transplanted. Refer to plans and directions from Landscape Architect.

3.11 GROUND COVER

A. Spacing: Space plant material in the areas and at the spacing shown, in neat rows, insuring complete coverage of all planting areas under and around trees and shrubs. Triangular spacing is required unless specified otherwise on plans. Pour Top Dress fertilizer around plant surface at indicated rates.

B. Watering: Water plants immediately after planting. No plant shall be out of their container more than thirty (30) minutes before being planted and watered.

C. Apply pre-emergent herbicide to all ground cover and shrub beds at conclusion of specified maintenance period. Do not use Casaron or Norasac Brands.

D. Mulching: Recultivate compacted soil, rake smooth and distribute bed mulch to a 1½"-2" depth on the surface of all ground cover and shrub areas. Remove any bed mulch that falls over the ground covers or shrubs. Do not apply Bed Mulch to wildflower beds, if used.

3.12 SEED BED PREPARATION AND PLANTING (for seeding of non-hydro-seed areas)

A. The Contractor shall notify the Landscape Architect not less than 24 hours in advance of any seed bed preparation, and shall not begin the work until areas prepared or designated for seeding have been approved. Seeding shall not be done during windy weather or when the ground is frozen. Seed and fertilizer shall be placed at the rate and mixture specified.

B. Seed bed preparation, fine grading, and fertilizing shall be the same as for sod installation specified in Paragraph 3.09 above, except that 38-0-0 shall be applied after germination.

Seed mix shall be applied at a rate of 6 lbs./1000 s.f. Seed mix shall consist of the following blend:

60% Turf Type Perennial Ryegrass
20% Bluegrass
20% Hard Fescue

C. Upon completion of seeding operations a mulch of finely ground peat moss shall be uniformly applied at the rate of 2 cubic yards per 1000 s.f. to obtain a ½" - ¾" depth.

D. Erect a temporary protective barrier of acceptable materials around all lawn areas and post warning signs, where necessary, to prevent damage or harmful effects to the lawn areas.

E. Prior to acceptance, the lawn shall be mowed a minimum of one cutting after the grass has attained a height of at least 2 inches. The cutting height shall not be less than 1 inch or exceed 2 inches in height with all cuttings removed. Acceptance of lawn planting as herein specified shall be based on a uniform stand of grass and uniform grade at the time of final inspection. Areas that are bare or have a poor stand of grass and areas not having a uniform grade throughout shall be reseeded and regraded until Landscape Architect gives final approval. The acceptance of seeded lawn areas shall not be contingent upon final inspection, but contingent upon a healthy, vigorous, established stand of grass. Completion of final inspection shall not free Contractor from responsibility for healthy, vigorous grass.

3.13 RESPONSIBILITY DURING CONSTRUCTION

A. The Contractor shall insure adequate and proper care of all plant material, and work done on this project until the contract is completed and accepted. Adequate and proper care shall include keeping all plant material in a healthy, growing condition.

B. The Contractor shall have sole responsibility for keeping the planted areas free from insect infestation, weeds and grass, litter, and other debris, along with retaining the finished grades in a neat uniform condition.

3.14 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition as determined by Landscape Architect/Owner. Failure to comply will result in a stop work order issued.

B. Protect landscape work and materials from damage due to landscape operations, operations by other Contractors, and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

C. Remove debris, soil and fertilizer from all paved surfaces, curbs and walks.

D. At completion of each area of work, remove all debris, equipment and surplus materials.

E. All material removed shall be disposed of off site by the Contractor.

3.15 PRE-MAINTENANCE

A. Pre-maintenance as herein specified shall immediately follow completion of each planting operation and shall continue through the General Inspection and until acceptance of the planting project.

B. Ground cover plants shall be kept in a healthy, vigorous growing condition by watering, replanting, weeding, and cultivation of the entire area of the bed.

C. Trees and shrubs shall be watered, weeded, cultivated and replaced immediately if not in a healthy growing condition.

D. Smooth grade all earth surfaces removing weeds, debris, and breaking clods and leave in an acceptable condition.

E. It is the Contractor's responsibility to protect all areas from damage during the installation and maintenance periods. This shall include damage caused by theft, vandalism or adverse weather conditions.

3.16 PUNCH LIST FIELD VISIT

A. A punch list field visit shall be requested by the Contractor when installation as set forth on drawings and specifications is substantially complete. Landscape Architect shall be given forty eight (48) hours notification prior to inspection.

B. Completion of general inspection, punch list items and acceptance of the contract work by the Owner's representative and the Landscape Architect shall release the Contractor from maintenance under paragraph PRE-MAINTENANCE above, and shall mark the start of the 60 day maintenance period under paragraph MAINTENANCE below.

3.17 MAINTENANCE

A. Maintenance as required under paragraph PRE-MAINTENANCE above shall extend for 60 consecutive calendar days following general inspection and acceptance of contract work. Additional maintenance activities for this 60 day period shall include:

1. Protect all areas against damage, including erosion and trespass, and provide all necessary safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespass.
2. Keep all walks and paved areas clean. Keep site free from debris resulting from landscape work and maintenance.
3. Repair all damaged planted areas and replace plants immediately upon discovery of damage or loss. Straighten and tighten tree stakes and guys as needed.
4. Check all barriers and temporary fencing daily during the work week and repair or replace immediately as needed.
5. Maintain adequate moisture in soil to ensure vigorous growth. This includes non-irrigated areas.
6. Keep contract areas free from weeds by cultivating, hoeing, or hand pulling. Use of chemical week killers will not relieve the Contractor of the responsibility for keeping areas free from weeds over 1 inch in height at all times.
7. Water, fertilize, and mow lawn areas in accordance with normal nursery practice and in accordance with these specifications.

a. Water lawn three times daily for ten (10) days. Following the 10 day period, watering shall be done in accordance with the Owner's watering schedule.
b. Lawn shall be fertilized with an accepted organic fertilizer every 30 days.
c. Lawn shall be kept at a height of between two (2) and three (3) inches at all times. Catch and remove all lawn cuttings after each mowing.

8. Immediately prior to completion of maintenance period, fertilize all trees and shrubs with liquid Alaska Fish Fertilizer a second time per paragraph D, Section 3.07.
9. During the 60 day maintenance period, Contractor is responsible for protecting all landscape areas as outlined in item "1". Any plants not in a healthy, vigorous, thriving condition at the end of the 60 day maintenance period shall be replaced, based on the Landscape Architect's judgement. This shall include plants damaged by theft, vandalism or adverse weather conditions.

3.18 FINAL PROJECT CLOSE-OUT

The final project close-out of work for acceptance of the work will be made at the conclusion of the 60 day maintenance period, upon successful completion of all punch list items and upon 4 days notice to the Landscape Architect requesting this site visit. At this visit, all plants must be in a healthy growing condition, weeds not in evidence, pruning complete, staking and tying secure, sprinkler risers vertical, and sprinklers performing as per manufacturer's description. Acceptance shall follow upon meeting these requirements. Acceptance of the final site visit shall mark the start of all workmanship and plant guarantees.

3.19 CLEAN-UP: Upon completion of the work under this section, Contractor shall remove from the premises all surplus materials, tools, equipment, rubbish, and debris; wash all dirt and fertilizer from pavements, curbs, walls and other structures resulting from his/her work and leave the work in clean, neat and workmanlike conditions satisfactory to the Landscape Architect.

3.20 GUARANTEE

A. The Contractor shall furnish to the Owner any guarantee or warranty furnished as a normal trade practice in connection with his purchase of any equipment, materials, or items which are to be incorporated into the project.

B. All plant materials shall be guaranteed to be in a living, healthy, and disease free condition from the date of acceptance to the completion of one full year, or one full growing season, whichever is longer. One full growing season shall be considered for the purpose of this contract as the period from April 1st to October 1st of any given year. Any plant material replaced during the guarantee period will again be thus guaranteed. Contractor shall not be held responsible for theft, vandalism or adverse weather conditions beyond the 60 day maintenance period.

END OF SECTION 329100

SECTION 331000 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes but is not limited to: Furnishing, layout, and installing waterlines, gate valves, check valves, fittings; Connections to existing water mains; Connections to building piping for new fire sprinkler systems.

B. Coordinate work with related work specified in other parts of the Specifications, including but not limited to the following:

1. Section 01 33 23 “Submittal Procedures”
2. Section 31 20 00 “Earth Moving”
3. For Interior Plumbing systems, refer to Division 15.

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. WSDOT-APWA: Standard Specification for Road, Bridge and Municipal Construction, 2016, as modified by the City of Lakewood Engineering Standards, here after referred as the “Standard Specification”

1.4 SUBMITTALS

A. Comply with pertinent provisions of Section 013323 “Submittal Procedures”. Submit Manufacturer's Literature on proposed material prior to the start of any work; submit three copies of product information correlated to specified requirements.

B. No installation of the material concerned shall be made until written approval has been obtained from the Engineer. Approval of materials and equipment shall in no way obviate compliance with the plans and specifications.

1.5 RECORD DRAWINGS

A. One complete set of drawings will be provided as record drawings which shall be separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed.

B. These drawings shall also serve as work progress report sheets and the Contractor shall make any notations, neat and legible, thereon daily as work proceeds. These drawings shall be available for inspection at all times and shall be kept at the job.

C. All buried piping and indicated future connections, exterior of any building, shall be located both by depth and by accurate measurement from a permanently established landmark. All notations on record drawings of buried piping shall be made before any backfilling is started.

D. At completion of the work, these record drawings shall be signed by the Contractor, dated, and returned to the Architect.

E. In addition, a survey of the newly installed water mains shall be prepared by a licensed surveyor in the State of Washington and submitted to the owner. Survey shall include location of bends, tees, valves, metes, hydrants; pipe length, size, and material. The Horizontal Datum NAD 83/91shall be and the Vertical Datum shall be NAVD 88.

1.6 QUALITY ASSURANCE

A. All Contractors installing, inspecting, servicing or maintain fire protection systems shall be licensed by the State Director of Fire Protection Services in accordance with Chapter 18.106 RCW.

B. Contractor is responsible for coordinating water main and fire system work on site with City of Lakewood.

C. Standard Compliance: In addition to complying with all codes and regulation, comply with all pertinent recommendations contained in the following documents. When a conflict arises between the following standards, the more stringent provision shall apply. Delete references to measure and payment.

D. Manufacturer's and Installer's Qualifications: Firms regularly engaged in manufacture or installation of water projects consisting of similar scope and materials.

E. General: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Piping: Inspect materials delivered to the site for damage. Store with minimum of handling. Store materials on site in enclosures or under protective coverings. Do

not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

2. Metal Items: Check upon arrival and identify and segregate as to types, functions, and sizes. Store in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
3. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound, undamaged condition. Take special care not to damage fittings. Carry pipe to trench; do not drag it.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tracer Tape: Shall be per Section 312000 for Water Service.

B. Ductile Iron Pipe: shall be in accordance with Section 9-30.1(1) of the Standard Specifications, except the thickness shall be Class 52. It shall be manufactured in accordance with the requirements of AWWA C151 with a cement-mortar lining, conforming to AWWA C104).

1. Approved manufactures include: Pipe and Foundry Company, Pacific States Cast Iron Pipe Company, Griffin Pipe Company, or American Pipe Company

C. Polyethylene Encasement: Encase ductile iron pipe with 8 ml tube or sheet polyethylene encasement. Material and construction shall conform to AWWA C105/A21.5. Installation shall be in accordance with Method A or Method C.

D. Fittings:

1. Pipe fittings for water mains shall be short body, ductile iron, for 150 PSI working pressure. They shall be mechanical joint conforming to AWWA Specifications C153.
2. Restrained Joint shall be one of the following:

a. American Ductile Iron Pipe (Flex-Ring)
b. Cooper B-Line B3132–Stainless Steel or Heavy Duty Hot Dipped Galvanized pipe clamps
c. (embedded in concrete blocks)US Pipe (TR FLEX)
d. EBAA Iron (MEGALUG 1100 Series)
e. EBAA Iron (MEGAFLANGE 2100 Series)
f. Griffin Pipe Products Company (Snap-Lok, Bolt-Lok)
g. Pacific States Cast Iron Pipe Co, (Thrust Lock)
h. Romac (Grip Ring), 600 Series, RomaGrip
i. Romac (Bell Restraint) 611 with 316SS stainless steel nuts and bolts
j. Star National Products (Shackle Products) - All rods and hardware shall be 316SS stainless steel.
k. Uni-Flange Corporation Series 1400, or Series 1450 with 316SS stainless steel nuts and bolts

E. Service pipes 1-1/2 inch and 2-inch: shall be CTS, SDR9, 200 PSI, ASTM D2737 polyethylene pipe.

F. Gate Valves:

1. The minimum requirements for gate valves 2" to 12" shall in design, material, and workmanship, conform to the Standards of AWWA C509.
2. All gate valves shall be Mueller or AVK resilient wedge gate valves.
3. All gate valves shall be non-rising stems, furnished with O-Ring stem seals. Number, size and design shall conform to Section 3.12 of the AWWA Standards for gate valves.

G. Valve boxes shall cast iron valve boxes and lids shall be USA-Seattle/Tacoma style.

H. Fire Hydrants shall conform to AWWA 502, UL 246 and FM 1510 specifications.

1. Fire Hydrants shall be Mueller A423 Super Centurion 250

I. Fire Protection Connections: shall be in accordance with NFPA-13 and NFPA-20. Fire Department Connection (FDC) shall be per City of Lakewood Fire Department. Coordinate with building sprinkler connections shown on mechanical drawings and as constructed by the building sprinkler installer.

J. Concrete for Thrust Blocks: shall be not less than 1800 PSI at 7 days and 3000 PSI at 28 days.

K. Pipe Bedding and Backfill material: shall be per Section 312000 and the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site and Drawings: Carefully examine the site and compare the drawings with existing conditions. By the act of submitting bids, the Contractor shall be deemed to have made such examination and to have accepted such conditions, and to have made allowance therefore in preparing their figure.

B. Verification of Existing Elevations: Verify all connection elevations prior to laying pipe. Dimensions and Layout shall be in conformance with Section 311000 "Site Preparation".

C. Verification of Dimensions: Before proceeding with any work, the Contractor shall carefully check and verify all dimensions, sizes, etc. and shall assume full responsibility for the fitting in of his equipment and to the structure. Where apparatus and equipment have been taken from typical equipment of the class indicated, the Contractor shall carefully check the drawings to see that the equipment he contemplates installing will fit into the spaces.

3.2 INSTALLATION

A. All trenching shall conform to the Washington Administrative Code (WAC) 296-155 requirements for Excavation, Trenching and Shoring. Install trench excavation, foundation bedding, and backfill for water mains in accordance with Section 7-09.3(7) of the Standard Specifications.

B. Join pipe sections in such a manner as not to damage the lining or coating. Any damage to the lining or coating shall be repaired by the Contractor and at the Contractor's expense.

C. Coordinate with work of Division 15 for domestic and fire service pipe into the building.

D. Install pipe, fittings and appurtenances in accordance with Section 7-09.3(12) of the Standard Specifications, and in accordance with manufacturer's instructions.

E. Fire protection piping: Shall be installed in accordance with NFPA-13 and NFPA-20. All piping shall be installed straight, true and plumb. Fittings at joints shall be restrained joint in accordance with NFPA 13 with thrust blocking and Megalugs or Field LOK gaskets.

F. Fire Hydrants: Shall be installed per Section 7-14 of the Standard Specifications.

G. Connections to existing mains: Shall be in accordance with Section 7-09.3(19)A of the Standard Specifications. Flush and disinfect lines prior to connection in accordance with Section 7-09.3(24) of the Standard Specifications.

H. Service connections:

1. Tapping of polyethylene encased ductile iron pipe shall be performed by wrapping three layers of polyethylene compatible adhesive tape completely around the pipe to cover the area where the direct tapping machine and chain will be mounted.
2. Where a saddle is used in lieu of direct tapping, make a cut in the taped area large enough to accommodate the gasket directly in contact with the ductile iron pipe. Make necessary repair for damaged encasement.
3. The existing polyethylene encasement shall be field cut and replaced after the tap is installed.

I. Thrust Blocking: shall be in accordance with the Contract Documents.

3.3 TESTING AND DISINFECTION

A. The Contractor shall be responsible for conducting pressure testing and testing for purity.

B. A hydrostatic pressure test shall be performed for all new water mains per Section 7-09.3(23) of the Standard Specifications.

C. Water lines shall be purified per Section 7-09.3(24) of the Standard Specifications. Final connections shall not be made until Western State Hospital has approved the results of the tests.

END OF SECTION 331000

SECTION 333000 SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work includes but is not limited to following:

1. Furnishing and installing sanitary sewer piping, cleanouts, and manholes.
2. Furnishing and installing sanitary side sewer piping.
3. Furnishing and installing sanitary sewer lift station.
4. Coordination and connections to building plumbing.
5. Connections to existing sanitary sewer systems.

B. Coordinate related work specified in other parts of the Project Manual, including but not limited to following:

1. Section 01 33 23 “Submittal Procedures”
2. Section 31 20 00 “Earth Moving”
3. Section 21 Building Plumbing.

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. City of Steilacoom Engineering Standards Manual (Current Edition)
2. WSDOT-APWA: Standard Specification for Road, Bridge and Municipal Construction, 2016, as modified by the City of Lakewood Engineering Standards, here after referred at the “Standard Specification”.

1.4 SUBMITTALS

A. Comply with pertinent provisions of Section 013323 “Submittal Procedures”. Submit Manufacturer's Literature on proposed material prior to the start of any work; submit three copies of product information correlated to specified requirements.

B. No installation of the material concerned shall be made until written approval has been

obtained from the Engineer. Approval of materials and equipment shall in no way obviate compliance with the plans and specifications.

1.5 RECORD DRAWINGS:

A. One complete set of drawings will be provided as record drawings which shall be separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed.

B. These drawings shall also serve as work progress report sheets and the Contractor shall make any notations, neat and legible, thereon daily as work proceeds. These drawings shall be available for inspection at all times and shall be kept at the job.

C. All buried piping and indicated future connections, exterior of any building, shall be located both by depth and by accurate measurement from a permanently established landmark. All notations on record drawings of buried piping shall be made before any backfilling is started.

D. At completion of the work, these record drawings shall be signed by the Contractor, dated, and returned to the Architect.

E. In addition, a survey of the newly installed water mains shall be prepared by a licensed surveyor in the State of Washington and submitted to the owner. Survey shall include location of bends, tees, valves, metes, hydrants; pipe length, size, and material. The Horizontal Datum NAD 83/91shall be and the Vertical Datum shall be NAVD 88.

1.6 QUALITY ASSURANCE

A. Standard Compliance: In addition to complying with all codes and regulation, comply with all pertinent recommendations contained in the following documents. When a conflict arises between the following standards, the more stringent provision shall apply. Delete references to measure and payment.

B. Manufacturer's and Installer's Qualifications: Firms regularly engaged in manufacture or installation of sewer projects consisting of similar scope and materials.

C. General: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Piping: Inspect materials delivered to the site for damage. Store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

2. Cement: Store cement immediately upon receipt at site of work. Store bagged cement in a suitable waterproof structure made as air-tight as practicable, and with floors elevated above ground a sufficient distance to prevent absorption of moisture. Stack bags close together to reduce circulation of air, but do not stack against outside walls; arrange storage to permit easy access for inspection and identification of each shipment.
3. Metal Items: Check upon arrival and identify and segregate as to types, functions, and sizes. Store in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound, undamaged condition. Take special care not to injure fittings. Carry pipe to trench; do not drag it. Do not leave rubber gaskets and plastic piping that are not to be installed immediately in the sunlight, but store under cover out of direct sunlight.

C. Dimensions and Layout shall be in conformance with Section 311000 “Site Preparation”.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gravity Sewer Pipe: Gravity Sewer Pipe shall be Solid Wall PVC Sanitary Sewer Pipe in accordance with Section 9.05.12-1 of the Standard Specifications.

B. Pipe Joints: shall be conform to Section 9.05.12-1 of the Standard Specifications.

C. Cleanouts: Clean-outs shall conform to the Contract Document and Section 9-05.15 of the Standard Specifications.

D. Manhole Ring & Cover: Structures shall be in accordance with the Contract Document and Section 9-05.15(2) of the Standard Specifications.

E. Structures: Sanitary Sewer Manholes shall be in accordance with Section 9-05.50(2)

F. Sewer Lift Station shall be per the Contract Documents.

G. Tracer Tape: Utility pipe tracer tape shall per Section 312000.

PART 3 - EXECUTION

3.1 TRENCHING

A. Trenching shall be in accordance with Section 7-08.3(1) of the Standard Specifications.

B. Excavation shall be made to alignment, elevation, grade and slope as indicated on the drawings, and as directed by Section 7-08.3(2)A of the Standard Specifications.

C. Accomplish trenching utilizing equipment with slope and depth control, such as "laser

plane control system", so as to insure accuracy in the bottom of the trench and placement of the pipe. No high points above designated invert or calculated trench bottom elevation will be permitted. No sloughing of site material or loose excavated soil will be permitted in trenches.

3.2 TRENCHES

A. Trenches shall be in straight lines as indicated on the drawings. Where feasible, trench width at the top shall be no greater than 24". If sloughing of trench side is encountered, a cribbing form will be required to maintain trench side stability. Excavate to a depth below invert grade to allow for bedding as specified.

B. Keep the trench free from water until pipe is laid and backfilled. Divert all surface water so as not to enter the trench. Entirely remove boulders, rocks, roots and other obstructions, or cut out to the width of the trench and to a depth of 6" below the elevation of bottom of pipe. Remove and dispose of all loose and excess excavated materials off-site at Contractor's prearranged location.

3.3 PIPE LAYING

A. Lay pipe in accordance with Section 7-08.3(2)B of the Standard Specifications.

B. Make all connections with approved fittings as recommended and furnished by the manufacturer. Make connections to existing sewer lines at locations shown on the drawings.

C. Install tracer tape per manufacturer's direction above all non-metallic sewer lines.

3.4 BEDDING AND BACKFILLING

A. Bedding shall be per Section 7-08.3(1)C of the Standard Specifications and the contract documents.

B. Backfilling shall be in accordance with Section 7-08.3(3) of the Standard Specifications.

3.5 CLEANING AND FLUSHING

A. Prior to testing the contractor will clean and flush all installed lines per Section 7-17.3(2) of the Standard Specifications.

3.6 TESTING

A. All gravity sewers shall undergo Exfiltration testing per Section 7-17.3(2)B of the Standard Specifications, Low Pressure Testing per Section 7-17.3(2)F of the Standard Specifications.

3.7 TELEVISION INSPECTION

A. The Contractor shall provide the owner with a videotape of all sanitary sewers prior to

acceptance per Section 7-17.3(2)H of the Standard Specifications.

B. The Contractor shall correct all deficiencies found during televisions inspection.

END OF SECTION 333000

SECTION 334100 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes but is not limited to: Furnishing, layout and installing catch basins, control structures, infiltration systems, water quality systems, storm drainage piping, and footing drains as indicated on the drawings.

B. Coordinate work with related work specified in other parts of the Specifications, including but not limited to the following:

1. Section 013323 “Submittal Procedures”
2. Section 312000 “Earthwork”
3. For Interior Plumbing systems, refer to Division 15.

1.3 REFERENCES

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this section insofar as specified and modified herein. The Contractor shall have one copy of the each of the following documents at the job site. The bidder in submitting a bid acknowledges that he is familiar with the documents named in References and that they are incorporated into this document by reference. The Standard Plans and Policies apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurements and payment sections do not apply to this document.

1. City of Lakewood Engineering Standards Manual (Current Edition)
2. WSDOT-APWA: Standard Specification for Road, Bridge and Municipal Construction, 2016, as modified by the City of Lakewood Engineering Standards, here after referred at the “Standard Specifications”.

1.4 SUBMITTALS

A. Comply with pertinent provisions of Section 013300. Submit Manufacturer's Literature on proposed material prior to the start of any work; submit three copies of product information correlated to specified requirements.

B. No installation of the material concerned shall be made until written approval has been obtained from the Engineer. Approval of materials and equipment shall in no way obviate compliance with the plans and specifications.

1.5 RECORD DRAWINGS:

A. One complete set of drawings will be provided as record drawings which shall be separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed.

B. These drawings shall also serve as work progress report sheets and the Contractor shall make any notations, neat and legible, thereon daily as work proceeds. These drawings shall be available for inspection at all times and shall be kept at the job.

C. All buried piping and indicated future connections, exterior of any building, shall be located both by depth and by accurate measurement from a permanently established landmark. All notations on record drawings of buried piping shall be made before any backfilling is started.

D. At completion of the work, these record drawings shall be signed by the Contractor, dated, and returned to the Architect.

E. Permanent Infiltrations Systems: the following information shall be included on the Record Drawings:

1. Bottom of each facility: surface area and elevation
2. Pipe diameter, elevation, and length as applicable
3. Riser pipe elevation

F. In addition, a survey of the newly installed water mains shall be prepared by a licensed surveyor in the State of Washington and submitted to the owner. Survey shall include location of bends, tees, valves, metes, hydrants; pipe length, size, and material. The Horizontal Datum NAD 83/91shall be and the Vertical Datum shall be NAVD 88.

1.6 QUALITY ASSURANCE

A. Standard Compliance: In addition to complying with all codes and regulation, comply with all pertinent recommendations contained in the following documents. When a conflict arises between the following standards, the more stringent provision shall apply. Delete references to measure and payment.

B. Manufacturer's and Installer's Qualifications: Firms regularly engaged in manufacture or installation of sewer projects consisting of similar scope and materials.

C. General: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:

1. Piping: Inspect materials delivered to the site for damage. Store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Cement: Store cement immediately upon receipt at site of work. Store bagged cement in a suitable waterproof structure made as air-tight as practicable, and with floors elevated above ground a sufficient distance to prevent absorption of moisture. Stack bags close together to reduce circulation of air, but do not stack against outside walls; arrange storage to permit easy access for inspection and identification of each shipment.
3. Metal Items: Check upon arrival and identify and segregate as to types, functions, and sizes. Store in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
4. Handling: Handle pipe, fittings, and other accessories in such a manner as to ensure delivery to the trench in sound, undamaged condition. Take special care not to injure fittings. Carry pipe to trench; do not drag it. Do not leave rubber gaskets and plastic piping that are not to be installed immediately in the sunlight, but store under cover out of direct sunlight.

B. Dimensions and Layout shall be in conformance with Section 311000 “Site Preparation”.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tracer Tape: Shall be per Section 312000 for Storm Sewer Pipe.

B. Storm Drain Pipe: Shall be in accordance with the following Specifications.

1. Solid Wall PVC Pipe per Section 9-05.12(1) of the Standard Specifications.
2. Corrugated Polyethylene Pipe per Section 9-05.20 of the Standard Specifications.

C. Pipe Bedding and Backfill material: shall be per in accordance with Section 312000, Earth Moving.

D. Manholes and Catch basins: shall be in accordance with Section 9-05.50(2) and 9-05.50(3) of the Standard Specifications.

E. Area Drains shall be as indicated in the contract documents.

F. Metal Castings: Metal castings for manhole rings, round covers, frames, grates, and rectangular covers shall conform to City of Lakewood Standard Details and Section 9-05.15 of the Standard Specifications. All covers shall be bolt locking ductile iron with cast iron frames. Locking bolts shall be 5/8” – 11NC stainless steel type 304 socket (allen) head bolts, 2-inches long.

G. Drain Rock shall be per Specification 312000 “Earth Moving”.

H. Footing drains exterior to the building foundations: Footing drain pipe material shall be PolyVinyl Chloride (PVC) pipe, SDR 35, with 1/8th wide laser cut slotted perforations or drilled holes 3/16th to ¼" diameter.

I. Infiltration Pipe shall be one of the following pipes listed below with Class 2 Perforations per ASTM A760, A752, and B745.

1. Lined corrugated polyethylene pipe (LCPE)
2. Aluminized Type 2 corrugated steel pipe and pipe arch (meets AASHTO designations M274 and M36)
3. Corrugated or spiral rib aluminum pipe and pipe arch
4. Reinforced concrete pipe
5. Corrugated steel pipe and pipe arch, Aluminized or Galvanized with treatments 1 through 6
6. Spiral rib steel pipe, Aluminized or Galvanized with treatments 1 through 6

2.2 WATER QUALITY SYSTEM:

A. Internal Components

1. All internal components including ABS and PVC manifold piping, filter cartridges, filter media (as specified on the plans in the StormFilter data block), sump covers, flow spreaders, and energy dissipaters shall be provided by CONTECH Construction Products Inc.
2. ABS manifold pipe shall meet ASTM specification F628. PVC manifold pipe shall meet ASTM specification D1785 and PVC fittings shall meet ASTM specification D2466.
3. Filter cartridge bottom pan, inner ring, and hood shall be constructed from linear low-density polyethylene (LLDPE) or ABS. Filter cartridge screen shall consist of 1" x ½" welded wire fabric (16-gauge minimum) with a bonded PVC coating. Internal parts shall consist of ABS or PVC material. Siphon-priming float shall be constructed from high-density polyethylene (HDPE). All miscellaneous nuts, bolts, screws, and other fasteners shall be stainless steel or aluminum.
4. An orifice plate shall be supplied with each cartridge to restrict flow rate to a maximum of 22.5 gpm at system design head or as specified on drawings.
5. Inlet pipe, outlet sump and overflow shall be constructed of ABS and sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or equal. Contractor to provide sealant material and installation unless completed prior to shipment.
6. Flow spreader shall be constructed of LLDPE.
7. Energy dissipater shall be constructed of polyolefins.
8. Filter media shall be provided by CONTECH Construction Products Inc., or approved alternate source. Filter media shall consist of the following as specified in the StormFilter data block:
    a. Zeolite-Perlite-Granular Activated Carbon (ZPG): ZPG is a mixed media that shall be composed of a 1.3 ft^3 outer layer of 100% Perlite (see below) and a 1.3 ft^3 inner layer consisting of a mixture of 90% Zeolite (see below) and 10% Granular Activated Carbon (see below).

b. Perlite Media: Perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The perlite media shall have a bulk density ranging from 6.5 to 8.5 lb/ft^3 and particle sizes ranging from that passing through a 0.50-inch screen and retained on a U.S. Standard #8 sieve.

c. Zeolite Media: Zeolite media shall be made of naturally occurring clinoptilolite, which has a geological structure of potassium-calcium-sodium aluminosilicate. The zeolite media shall have a bulk density ranging from 44 to 48 lb/ft^3, particle sizes ranging from that passing through a U.S. Standard #4 sieve to that retained on a U.S. Standard #6 sieve, and a cation exchange capacity ranging from 1.0 to 2.2 meq/g.

d. Granular Activated Carbon: Granular activated carbon (GAC) shall be made of lignite coal that has been steam activated. The GAC media shall have a bulk density ranging from 28 to 31 lb/ft^3 and particle sizes ranging from that passing through a U.S. Standard #4 sieve to that retained on a U.S. Standard #8 sieve.

B. Precast Concrete Vault Components

1. Precast concrete vault shall be provided according to ASTM C857 and C858.
2. Vault joint sealant shall be Conseal CS-101 or approved equal.
3. Interior concrete baffle walls shall be sealed to the interior vault walls and floor with a polyurethane construction sealant rated for use below the waterline, SikaFlex 1a or equal.
   a. Contractor to provide sealant material and installation.
4. Frames and covers shall be gray cast iron and shall meet AASHTO H-20 loading requirements, and shall be provided according to ASTM A48.
5. Doors shall have hot-dipped galvanized frame and covers. Covers shall have diamond plate finish. Each door to be equipped with a recessed lift handle. Doors shall meet H-20 loading requirements for incidental traffic, at a minimum.
6. Steps shall be constructed of copolymer polypropylene conforming to ASTM D-4101. Steps shall be driven into preformed or drilled holes once concrete is cured. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. The ½" Grade 60 deformed reinforcing bar shall meet ASTM A-615.
7. Ladders shall be constructed of aluminum and steel reinforced copolymer polypropylene conforming to ASTM D-4101. Ladder shall bolt in place. Ladder shall meet all ASTM C-497 load requirements. Ladders provided upon request or where required.

C. Contractor Provided Components

1. All contractor-provided components shall meet the requirements of this section, the plans specifications and contract documents. In the case of conflict, the more stringent specification shall apply.
2. Crushed rock base material shall be six-inch minimum layer of ¾-inch minus rock. Compact undisturbed sub-grade materials to 95% of maximum density at +/-2% of optimum moisture content. Unsuitable material below sub-grade shall be replaced to geotechnical engineer's approval.

3. Concrete shall have an unconfined compressive strength at 28 days of at least 3000 psi, with ¾-inch round rock, a 4-inch slump maximum, and shall be placed within 90 minutes of initial mixing.
4. Silicone Sealant shall be pure RTV silicone conforming to Federal Specification Number TT S001543A or TT S00230C or Engineer approved.
5. Grout shall be non-shrink grout meeting the requirements of Corps of Engineers CRD-C588. Specimens molded, cured and tested in accordance with ASTM C-109 shall have minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.
6. Backfill material shall be per Section 312000 “Earth Moving” and the Contract Documents.

PART 3 - EXECUTION

3.1 STANDARDS

A. Execution shall be per Section 7.08-3 of the Standard Specifications.

3.2 EXAMINATION

A. Site and Drawings: Carefully examine the site and compare the drawings with existing conditions. By the act of submitting bids, the Contractor shall be deemed to have made such examination and to have accepted such conditions, and to have made allowance therefore in preparing his figure.

B. Verification of Existing Elevations: Verify all connection elevations prior to laying pipe.

C. Verification of Dimensions: Before proceeding with any work, the Contractor shall carefully check and verify all dimensions, sizes, etc. and shall assume full responsibility for the fitting-in of his equipment and to the structure. Where apparatus and equipment have been taken from typical equipment of the class indicated, the Contractor shall carefully check the drawings to see that the equipment he contemplates installing will fit into the spaces.

3.3 INSTALLATION

A. Drainage Structures: Construct catch basins, culverts, manholes, and other drainage structures at locations, and to the design and dimensions indicated. Set covers and grates flush with finished surface in paved and concrete areas or 3 inches above finished grade in landscaped areas. Exposed concrete work shall have a smooth troweled finish with rounded corners and edges finished plumb and true. Provide grates, frames, and covers for catch basins as detailed and indicated.

B. Tracer Tape: During backfilling of storm drain systems, install continuous underground-type plastic line marker, located directly over buried line at six to eight inches below finished grade or per manufactures recommendation.

C. Excavation, Bedding, and Backfill:

1. Trenching shall conform to Section 7-08.3(1) of the Standard Specifications. The length of trench excavation in advance of pipe laying shall be kept to a minimum, and in no case shall exceed 200 feet unless specifically authorized by the Engineer.
2. Where trench excavation equals or exceeds a depth of 4 feet, the contractor shall provide, construct, maintain and remove, as required, safety systems that meet the requirements of the Washington Industrial safety and Heal Act, RCW 49.17, including WAC 296-155 per Section 7-08.3(1)B of the Standard Specifications.
3. Excavation for structures: shall be in accordance with Section 7-05.3 of the Standard Specification.
4. Bedding: Bedding shall be installed in accordance with Standard Specification Section 7-08.3(1)C and the Contract Documents. Bedding shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. No blocking of any kind shall be used to adjust the pipe to grade except when used with embedment concrete. Bell holes shall be dug as required to ensure uniform support along the pipe barrel. Bedding disturbed by pipe movement or by removal of shoring or movement of a trench shield or box shall be reconsolidated prior to backfill.

D. Laying Pipe: Shall be in accordance with Section 7-08.3(2) of the Standard Specification. The contractor shall comply with manufacturer's recommended tolerance for eccentricity.

E. Line and Grade: Variance from established line and grade shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surface, does not exceed one sixty-fourth (1/64) per inch of pipe diameter, or one-half (1/2) inch maximum.

F. Connections: Connections to manholes shall be made in accordance with the drawings. Pipe branches, stubs or other open ends which are not to be immediately connected shall be capped or plugged.

G. Backfill: Shall be in accordance with Section 7-08.3(3); material shall be per Section 312000. Backfill shall be placed in successive layers with the first layer not to exceed 2 feet above the pipe, and the following layers not exceeding 12 inches in loose thickness, with each layer compacted to the required density. Trenches shall be backfilled as soon after the pipe laying as possible. Backfill trenches in the vicinity of catch basins, manholes, or other appurtenances will not be permitted until the masonry has become thoroughly hardened. Backfill above the pipe zone will be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading.

H. Precast CONTECH Concrete Vault

1. Set precast vault on crushed rock base material that has been placed in maximum 12-inch lifts, loose thickness, and compacted to at least 95-percent of the maximum dry density as determined by the standard Proctor compaction test, ASTM D698, at moisture content of +/-2% of optimum water content.

2. Vault floor shall slope 1/4 inch maximum across the width and slope downstream 1 inch per 12 foot of length. Vault top finish grade shall be even with surrounding finish grade surface unless otherwise noted on plans.
3. Inlet and outlet pipes shall be stubbed in and connected to precast concrete vault according Part 3 of this spec.
4. If grout is used, Contractor to grout all inlet and outlet pipes flush with or protruding up to 2 inches into interior of vault.

I. Filter Cartridges

1. Filter cartridges shall be delivered with the vault. Contractor shall take appropriate action to protect the cartridges from sediment and other debris during construction. Methods for protecting the cartridges include but are not limited to:
   a. Remove cartridges from the vault and store appropriately. Cartridges shall be reinstalled to operate according to 3.4 B (see below).
   b. If vault is equipped with under drain bypass piping, Contractor may leave cartridges in the vault and allow stormwater entering collection system to bypass filter bay through under drain bypass piping.
   c. Leave cartridges in the vault and plug inlet and outlet pipe to prevent stormwater from entering the vault.
   d. The method ultimately selected shall be at Contractor's discretion and Contractor's risk.

2. Filter cartridges shall not be placed in operation until the vault is clean and the project site is clean and stabilized (construction erosion control measures no longer required). The project site includes any surface that contributes storm drainage to the StormFilter. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of dirt and sediments. Contact CONTECH Stormwater Solutions to assist with system activation and/or inspect the system for proper installation once site is clean and stabilized.
3. Contractor to install filter cartridges. Contact CONTECH for specific instructions on connector fittings.

J. Miscellaneous:

1. Removal of Water: The contractor shall at all times provide and maintain ample means and devices to remove and dispose of all water entering the trench excavation during the process of laying the pipe.
2. Preparation of Pipe: All pipe and fittings shall be carefully inspected before being laid and cracked, broken or defective pipe shall not be used in the work.

K. Restoration: At minimum, road paved areas shall be restored to existing thickness using like materials. Disturbed roadside-shoulders shall be restored with 6 inches of crushed surfacing top course. Disturbed cut and fill slopes shall be fertilized and re-seed.

L. Re-vegetation: It shall be the Contractors responsibility to restore all disturbed areas to their original state. Rough grade compact earth, fine grade, place topsoil, fertilize and

seed disturbed areas and perform all other necessary operations in accordance with specification section 02200 (earthwork) and 02480 (planting and seeding).

3.4 CLEANING

A. Cleanliness of Site: During progress of work, keep premises reasonably free of debris and waste materials.

B. Removal of Debris: Upon completion and before final acceptance of work, remove all debris, rubbish, left-over materials, tools, and equipment from site.

C. Clean and test in conformance with Section 7-04.3(1) of Standard Specification. All new lines shall be subjected to testing after installation. Tests shall be exfiltration test or air pressure test. Conduct tests in the presence of the Owner's representative.

D. Prior to acceptance of work, each line and structure shall be cleaned to ensure that the entire system is clean and free of obstructions of any nature and provide written certification attesting thereto. Mechanically remove all sediment displaced from lines from the system, and do not flush downstream.

END OF SECTION 334100

ADVERTISEMENT FOR BIDS

Sealed bids will be accepted for the following project:

PROJECT NO.:	2016-410 G (2-1)
TITLE:	Western State Hospital - New Kitchen Commissary Pharmacy
AGENCY:	E&AS for Department of Social and Health Services
PROJECT MANAGER:	Penny Koal, AIA, LEED AP
ESTIMATED BASE BID COST RANGE:	$17,685,000.00 to $18,185,000.00
SUBMITTAL TIME/DATE/LOCATION:	**Prior to 3:00 P.M., ~~Thursday~~ *Wednesday (Addendum 3),* February 21, 2018** **Dept. of Enterprise Services** **Engineering & Architectural Services** **Mail to: PO Box 41476, Olympia, WA 98504-1476** **Hand deliver to: Shipping & Receiving Room No. 1140, 1500 Jefferson Street SE, Olympia, WA 98501. Stop at lobby for directions.** Public Bid Opening will commence at approximately 3:05 P.M. at the same location.
BY:	Department of Enterprise Services Engineering & Architectural Services
PRE-BID WALK-THROUGH:	Two pre-bid conferences will be conducted: Wednesday, January 24, 2018 at 2:00 P.M and Thursday, February 01, 2018 at 2:00 P.M. Meet at Facilities Maintenance Office in Building 1. For directions to the site of the pre-bid walk-through, please contact the Consultant listed below. **These will be the only opportunities for bidders to inspect the project site.**

Contractors may obtain plans and specifications from American Reprographics Company, 2730 Occidental Ave S, Seattle, WA 98134 upon the deposit of $100.00 Please make checks payable to NAC Architecture. Plans must be returned in good condition within seven (7) days following bid date to obtain a refund of deposit. After seven days no refunds will be made.

Plans and specifications may be viewed at the following plan centers: Abadan Reprographics & Imaging, Spokane, WA; Associated Builders & Contractors, Spokane, WA; Associated General Contractors, Boise, ID; Builder's Exchange of Washington, Everett, WA; Daily Journal of Commerce

Plan Center, Portland, OR; Daily Journal of Commerce, Seattle, WA; Hermiston Plan Center, Hermiston, OR; Contractor Plan Center, Milwaukie, OR; Ridgeline Graphics (Wenatchee Plan Center), Wenatchee, WA; Spokane Regional Plan Center, Spokane, WA; Tri-City Construction Council, Kennewick, WA; Walla Walla Valley Plan Center, Walla Walla, WA; Weekly Construction Reporter, Bellingham, WA; Yakima Plan Center, Yakima, WA.

Please direct questions regarding this project to the office of the Consultant, NAC Architecture, 2025 First Avenue, Suite 300, Seattle, WA 98121, 206-441-4522. Within 24 hours following the bid opening, results will be available on E&A Services' web site at https://fortress.wa.gov/ga/apps/EASbids/BidResult.aspx.

The State of Washington prevailing wage rates are applicable for this public works project located in Pierce County. Bidders are responsible to verify and use the most recent prevailing wage rates. The "Effective Date" for this project is the Bid Form due date above. The applicable prevailing wage rates may be found on the Department of Labor & Industries website located at https://fortress.wa.gov/lni/wagelookup/prvWagelookup.aspx.

Mandatory 15% apprentice labor hours of the total labor hours are a requirement of the construction contract. Voluntary workforce diversity goals for this apprentice participation are identified in the Instructions to Bidders and Supplemental Conditions. Bidders may contact the Department of Labor & Industries, Apprenticeship Section, to obtain information on available apprenticeship programs.

In accordance with RCW 39.30.060, the Bidder is required to provide the names of the Subcontractors with whom the Bidder will **directly** subcontract for the performance of heating, ventilation and air conditioning (HVAC), plumbing and electrical for this project.

Supplemental Bidder Responsibility will be evaluated for this project. In determining Bidder responsibility, the Owner shall consider an overall accounting of the criteria set forth in "DIVISION 00 SUPPLEMENTAL RESPONSIBILITY CRITERIA". Please direct questions regarding this subject to the office of the Consultant.

The successful Bidder is required to register and create an account in the DES Diversity Compliance program (B2Gnow) at https://des.diversitycompliance.com. Voluntary numerical Diverse Business goals of 10% MBE, 6% WBE, 5% Washington Small Business, and 5% Veterans have been established for this project. Achievement of the goals is encouraged.

Bidders may contact the Office of Minority and Women's Business Enterprise (OMWBE) at http://OMWBE.wa.gov/ to obtain information on certified firms. Bidders may also utilize Washington Small Businesses registered in WEBS at https://fortress.wa.gov/ga/webs/ and Veteran-owned Businesses at http://www.dva.wa.gov/program/certified-veteran-and-servicemember-owned-businesses.

The State reserves the right to accept or reject any or all bids and to waive informalities.

STATE OF WASHINGTON
DEPARTMENT OF ENTERPRISE SERVICES
ENGINEERING & ARCHITECTURAL SERVICES

2016410Gadvto

Instructions to Bidders – November 2017

General Conditions – July 2010

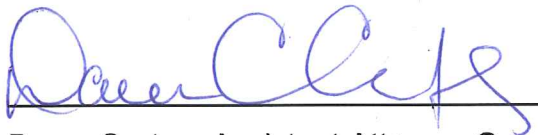
Supplemental Conditions – November 2017

For Washington State Facility Construction

Effective: November 7, 2017

Approved by:

William J. Frare, Assistant Director
Facility Professional Services



Dawn Cortez, Assistant Attorney General
Washington State Office of the Attorney General

Washington State Department of Enterprise Services

Facility Professional Services, Engineering & Architectural Services
PO Box 41476
Olympia, Washington 98504-1476
360.902.7272

INSTRUCTIONS TO BIDDERS
FOR WASHINGTON STATE FACILITIES CONSTRUCTION
November 7, 2017

PART 0 – GENERAL CONDITIONS

0.00 EXPLANATION TO PROSPECTIVE BIDDERS

A. In accordance with RCW 39.04.380 effective *March 30, 2012*, the State of Washington is enforcing a **Reciprocal Preference for Resident Contractors**. Any public works bid received from a nonresident contractor from a state that provides an in-state percentage bidding preference, a comparable percentage disadvantage must be applied to the bid of that nonresident contractor.

A nonresident contractor from a state that provides a percentage bid preference means a contractor that:

1. Is from a state that provides a percentage bid preference to its resident contractors bidding on public works contracts.

2. At the time of bidding on a public works project, does not have a physical office located in Washington.

The state of residence for a nonresident contractor is the state in which the contractor was incorporated or, if not a corporation, the state where the contractor's business entity was formed.

All nonresident contractors will be evaluated for out-of-state Bidder preference. If the state of the nonresident contractor provides an in-state contractor preference, a comparable percentage disadvantage will be applied to their bid prior to contract award.

This section does not apply to public works procured pursuant to RCW 39.04.155, 39.04.280, or any other procurement exempt from competitive bidding.

B. Any prospective Bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must submit a request in writing to the Architect/Engineer (A/E) seven (7) calendar days before the bid due date. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective Bidder concerning a solicitation will be furnished promptly to all other prospective Bidders by addendum to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective Bidders.

C. In accordance with the legislative findings and policies set forth in RCW 39.19 the State of Washington encourages participation in all of its contracts by MWBE firms certified by the Office of Minority and Women's Business Enterprises (OMWBE). Participation may be either on a direct basis in response to this invitation or as a subcontractor to a Bidder. However, unless required by federal statutes, regulations, grants, or contract terms referenced in the contract documents, no preference will be included in the evaluation of bids, no minimum level of MWBE participation shall be required as a condition for receiving an award, and bids will not be rejected or considered non-responsive on that basis. Any affirmative action requirements set forth in federal regulations or statutes included or referenced in the contract documents will apply.

D. The State of Washington encourages participation in all of its contracts by Veteran-owned businesses (defined in RCW 43.60.010) and located at http://www.dva.wa.gov/program/certified-veteran-and-servicemember-owned-businesses and Small, Mini and Micro businesses (defined in RCW 39.26.010) which have registered in WEBS at https://fortress.wa.gov/ga/webs/

1. In order to report payment detail, the Contractor must create an account with the DES Diversity Compliance program (B2Gnow) or verify if an account has already been created on behalf of the Contractor: https://des.diversitycompliance.com. B2Gnow is designed to streamline and automate compliance reporting requirements, empowering vendors to maintain accurate contact information and submit contract payment details online.

2. For account login or account creation details, please refer to the Quick Reference Guides located on pages 4 - 6 or go to B2Gnow home page by clicking on the URL listed above and clicking on the "Help/First Time Users" link.

3. Every month for the duration of your contract, and while your contract is active in the B2Gnow system, submit and accurately maintain the following payment information through B2Gnow:

    a. Payments received by the prime contractor from the Agency
    b. Payments paid to each subcontractor
    c. Payments paid to each supplier

You must also ensure the following information is reported in the B2Gnow system by your subcontractors and lower-tier subcontractors for the duration of your contract:

    a. Confirmation of payments from the prime contractor to the subcontractor
    b. Payment reporting to 2nd tier (and lower) subcontractors

E. In accordance with RCW 39.04.320 the state of Washington requires 15% **Apprenticeship Participation** for all projects estimated to cost one million dollars or more. On applicable projects, the bid advertisement and Bid Form shall establish a minimum required percentage of apprentice labor hours compared to the total labor hours. Bidders may contact the Department of Labor and Industries, Specialty Compliance Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530, by phone (360) 902-5320, and e-mail at Apprentice@lni.wa.gov, to obtain information on available apprenticeship programs.

0.01 PREPARATION OF BIDS – CONSTRUCTION

A. Bids must be: (1) submitted on the Bid Form, or copies of forms, furnished by the Owner or the Owner's agent, and (2) signed in ink. The person signing a bid must initial each change appearing on any Bid Form. If the bid is made by a corporation, it shall be signed by the corporation's authorized designee. The address of the Bidder shall be typed or printed on the Bid Form in the space provided.

B. The Bid Form may require Bidders to submit bid prices for one or more items on various bases, including: (1) lump sum base bid; (2) lump sum bid alternate prices; (3) unit prices; or (4) any combination of items 1 through 3 above.

C. If the solicitation includes alternate bid items, failure to bid on the alternates may disqualify the bid. If bidding on all items is not required, Bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

D. Substitute bid forms will not be considered unless this solicitation authorizes their submission.

0.02 BID GUARANTEE

A. When the sum of the base bid plus all additive bid alternates is $35,000.00 or less, bid security is not required.

When the sum of the base bid plus all additive alternates is greater than $35,000.00, a bid guarantee in the amount of 5% of the base bid amount is required. Failure of the Bidder to provide bid guarantee when required shall render the bid non-responsive.

B. Acceptable forms of bid guarantee are: A bid bond or postal money order, or certified check or cashier's check made payable to the Washington State Treasurer.

The Owner will return bid guarantees (other than bid bond) to unsuccessful Bidders as soon as practicable, but not sooner than the execution of a contract with the successful Bidder. The successful Bidder's bid guarantee will be returned to the successful Bidder with its official notice to proceed with the work of the contract.

C. The Bidder will allow 60 days from bid opening date for acceptance of its bid by the Owner.

The Bidder will return to the Owner a signed contract, insurance certificate and bond or bond waiver within 15 days after receipt of the contract. If the apparent successful Bidder fails to sign all contractual documents or provide the bond and insurance as required or return the documents within 15 days after receipt of the contract, the Owner may terminate the award of the contract.

D. In the event a Bidder discovers an error in its bid following the bid opening, the Bidder may request to withdraw its bid under the following conditions:

1. Written notification is received by the Owner within 24 hours following bid opening.

2. The Bidder provides written documentation of the claimed error to the satisfaction of the Owner within 72 hours following the bid opening.

The Owner will approve or disapprove the request for withdrawal of the bid in writing. If the Bidder's request for withdrawal of its bid is approved, the Bidder will be released from further obligation to the Owner without penalty. If it is disapproved, the Owner may retain the Bidder's bid guarantee.

0.03 ADDITIVE OR DEDUCTIVE BID ITEMS

The low Bidder, for purposes of award, shall be the responsive Bidder offering the low aggregate amount for the base bid item, plus additive or deductive bid alternates selected by the Owner, and within funds available for the project.

The Bidder agrees to hold all bid alternate prices for sixty (60) days from date of bid opening.

0.04 ACKNOWLEDGEMENT OF ADDENDA

Bidders shall acknowledge receipt of all addenda to this solicitation by identifying the addenda numbers in the space provided for this purpose on the Bid Form. Failure to do so may result in the bid being declared non-responsive.

0.05 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK

The Bidder acknowledges that it has taken steps necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to; (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and road; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during the work. The Bidder also acknowledges that it has satisfied itself as to character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including exploratory work done by the Owner, as well as from the drawings and specifications made a part of this contract. Any failure of the Bidder to take the actions described and acknowledged in this paragraph will not relieve the Bidder from responsibility for estimating properly the difficulty and cost of successfully performing the work.

0.06 BID AMOUNTS

A. The bid prices shown for each item on the Bid Form shall include all labor, material, equipment, overhead and compensation to complete all of the work for that item.

B. The actual cost of building permit (only) and the public utility hookup fees will be a direct reimbursement to the Contractor or paid directly to the permitting agency by the Owner. Fees for these permits should not be included by the Bidder in the bid amount.

C. The Bidder agrees to hold the base bid prices for sixty (60) days from date of bid opening.

0.07 TAXES

The bid amounts shall not include Washington State Sales Tax (WSST). All other taxes imposed by law shall be included in the bid amount. The Owner will include WSST in progress payments. The Contractor shall pay the WSST to the Department of Revenue and shall furnish proof of payment to the Owner if requested.

[NOTE: Contractor must bond for contract amount plus the WSST.]

0.08 SUBMISSION OF BIDS

A. Bids must be submitted on or before the time specified in the Advertisement for Bids.

B. Subcontractor Listing: If the base bid and the sum of the additive alternates is one million dollars or more, the Bid Form shall comply with the following requirements:

1. Pursuant to RCW 39.30.060, if the base bid and the sum of the additive alternates is one million dollars or more, the Bidder shall provide names of the Subcontractors with whom the Bidder will subcontract for performance of heating, ventilation and air conditioning (HVAC), plumbing, and electrical.

2. The Bidder can name itself for the performance of the work.

3. The Bidder shall not list more than one Subcontractor for each category of work identified UNLESS Subcontractors vary with bid alternates, in which case the Bidder must indicate which Subcontractor will be used for which alternate.

4. Failure of the Bidder to submit as part of the bid the NAMES of such Subcontractors or to name itself to perform such work shall render the Bidder's bid nonresponsive and, therefore, void.

C. The Bid Form shall be submitted in a sealed envelope addressed to the office specified in the Advertisement for Bids. The envelope shall have printed on the outside:

1. The project number and description.
2. The name and address of the Bidder.
3. Identification as Bid Form.

D. Prior to the bid opening, the Owner's representative will designate the official bid clock. Any part of the Bid Form, or in the rare situation of a bid modification, not received prior to the times specified, per the designated bid clock, will not be considered and the bid will be returned to the Bidder unopened.

E. A bid may be withdrawn in person by a Bidder's authorized representative before the opening of the bids. Bidder(s) representative will be required to show ID and sign on bid summary sheet before it will be released.

F. People with disabilities who wish to request special accommodation, (e.g., sign language interpreters, braille, etc.) need to contact the Owner ten (10) working days prior to the scheduled bid opening.

0.09 BID RESULTS

After the Bid Opening, Bidders may obtain bid results from the office of E&AS by calling (360) 902-7272 or by logging on to E&AS' web site: https://fortress.wa.gov/ga/apps/EASbids/BidResult.aspx. Bid results may also be obtained from the A/E.

0.10 LOW RESPONSIBLE BIDDER

A. **Mandatory Responsibility Criteria**: Before award of a public works contract, a Bidder must meet the following mandatory responsibility criteria under RCW 39.04.350 (1) & (2) to be considered a responsible Bidder and qualified to be awarded a public works project. The Bidder must:

1. At the time of bid submittal, have a certificate of registration in compliance with RCW 18.27;

2. Have a current state unified business identifier number;

3. If applicable, have industrial insurance coverage for the Bidder's employees working in Washington as required in RCW 51; an employment security department number as required in RCW 50; and a state excise tax registration number as required in RCW 82;

4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3);

5. If bidding on a public works project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington State Apprenticeship and Training Council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under RCW 49.04 for the one-year period immediately preceding the date of the bid solicitation; and

6. Within the three year period immediately preceding the date of the bid solicitation, not have been determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgement entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of RCW 49.46, 49.48, or 49.52. A bidder shall submit a signed Contractor Certification form with the bid form regarding this wage theft prevention responsible bidder criteria.

B. **Supplemental Responsibility Criteria:** In addition to the mandatory Bidder responsibility, the Owner may adopt relevant supplemental criteria for determining Bidder responsibility applicable to a particular project which the Bidder must meet (RCW 39.04.350 (3)).

1. If applicable, the Owner shall consider an overall accounting of the attached supplemental criteria for determining Bidder responsibility "DIVISION 00 SUPPLEMENTAL RESPONSIBILITY CRITERIA"**.**

2. At least seven (7) days prior to the bid submittal deadline, a potential Bidder may request that the Owner modify the supplemental responsibility criteria. The Owner will evaluate the information submitted by the potential Bidder and respond before the bid submittal deadline. If the evaluation results in a change of the criteria, the Owner will issue an addendum to the bidding documents identifying the new criteria.

3. Upon Owner's request, the apparent low Bidder must supply the requested responsibility information within two (2) business days of request by Owner. Withholding information or failure to submit all the information requested within the time provided may render the bid non-responsive

4. If the Owner determines that the apparent low Bidder is not responsible, the Owner will notify the Bidder of its preliminary determination in writing.

5. Within three (3) days after receipt of the preliminary determination, the Bidder may withdraw its bid or request a hearing where the Bidder may appeal the preliminary determination and present additional information to the Owner.

6. The Owner will schedule a hearing within three (3) working days of receipt of the Bidder's request. The hearing members will include a Client Agency Representative, EAS Assistant Director or designee, Deputy Assistant Director or designee, and Project Manager.

7. The Owner will issue a Final Determination after reviewing information presented at the hearing.

8. If the Owner determines a Bidder to be not responsible, the Owner will provide, in writing, the reasons for the determination. If the final determination affirms that the Bidder is not responsible, the Owner will not execute a contract with any other Bidder until two (2) business days after the Bidder determined to be not responsible has received the final determination.

9. The Owner's Final Determination is specific to this project, and will have no effect on other or future projects.

0.11 CONTRACT AWARD

A. The Owner will evaluate bids responsiveness and responsibility.

1. A bid will be considered responsive if it meets the following requirements:

a. It is received at the proper time and place.
b. It meets the stated requirements of the Bid Form.
c. It is submitted by a licensed/registered contractor within the state of Washington at the time of bid opening and is not banned from bidding by the Department of Labor and Industries.
d. It is accompanied by a bid guarantee, if required.
e. It is accompanied by a signed and completed "Contractor Certification Wage Theft Prevention – Responsible Bidder Criteria" of the bid form.

2. A bid will be considered responsible if it meets the following requirements:

a. It meets the mandatory responsibility criteria established in RCW 39.04.350 and an overall accounting of the supplemental responsibility criteria established for the project.

B. The Owner reserves the right to accept or reject any or all bids and to waive informalities.

C. The Owner may negotiate bid price adjustments with the low responsive Bidder, including changes in the contract documents, to bring the bid within the available funding per RCW 39.04.015.

D. The apparent low Bidder, for purpose of award, shall be the responsive and responsible Bidder offering the low aggregate amount for the base bid plus selected additive or deductive bid alternates and meeting all other bid submittal requirements.

E. **Reciprocal Preference for Resident Contractors**. For a public works bid received from a nonresident contractor from a state that provides an in-state percentage bidding preference, a Comparable Percentage Disadvantage (CPD) will be applied to the bid of that nonresident contractor. The CPD is the in-state contractor percent advantage provided by the contractor's home state.

For the purpose of determining the successful Bidder, multiply the Nonresident Contractor bid amount by the CPD. The "bid amount" shall be the total of the base bid and all accepted alternate bid items. The CPD shall be added to the Nonresident Contractor bid amount which equates to the Nonresident Disadvantage Total. The Nonresident Disadvantage Total shall be compared to the Washington contractor bid amounts. The Bidder with the lowest total shall be the successful Bidder. See example below:

EXAMPLE:

Alaska Nonresident Contractor Bid Amount	$100,000
Multiplied by the Alaska CPD	x 0.05
Alaska CPD Total	$ 5,000

Alaska Nonresident Contractor Bid Amount	$100,000
Alaska CPD Total	$ 5,000
Nonresident Disadvantage Total	$105,000*

* Note – If the Nonresident Disadvantage Total is lower than all other Washington contractor bid amounts, the Alaska Nonresident Contractor is the successful Bidder and will be awarded a contract for the bid amount of $100,000.

If the Nonresident Disadvantage Total is higher than a Washington contractor bid amount, the successful Washington Bidder will be awarded a contract for the bid amount.

F. The Contract will only become effective when signed by the Owner. Prior to the Owner's signature, any and all costs incurred shall be the sole responsibility of the Bidder.

0.12 DOCUMENTS (ATTACHED)

A. Advertisement for Bids
B. Bid Form
C. Supplemental Bidder Responsibility Criteria (if applicable)
D. Certificate of Insurance form
E. Special Conditions (if applicable)

Note: AIA Payment Bond and Performance Bond current forms (A312) are required, when applicable. These forms will <u>not</u> be provided by the Owner.

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PART 1 – GENERAL PROVISIONS

1.01 DEFINITIONS

A. "Application for Payment" means a written request submitted by Contractor to A/E for payment of Work completed in accordance with the Contract Documents and approved Schedule of Values, supported by such substantiating data as Owner or A/E may require.

B. "Architect," "Engineer," or "A/E" means a person or entity lawfully entitled to practice architecture or engineering, representing Owner within the limits of its delegated authority.

C. "Change Order" means a written instrument signed by Owner and Contractor stating their agreement upon all of the following: (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any, and (3) the extent of the adjustment in the Contract Time, if any.

D. "Claim" means Contractor's exclusive remedy for resolving disputes with Owner regarding the terms of a Change Order or a request for equitable adjustment, as more fully set forth in Part 8.

E. "Contract Award Amount" is the sum of the Base Bid and any accepted Alternates.

F. "Contract Documents" means the Advertisement for Bids, Instructions for Bidders, completed Bid Form, General Conditions, Modifications to the General Conditions, Supplemental Conditions, Public Works Contract, other Special Forms, Drawings and Specifications, and all addenda and modifications thereof.

G. "Contract Sum" is the total amount payable by Owner to Contractor, for performance of the Work in accordance with the Contract Documents, including all taxes imposed by law and properly chargeable to the Work, except Washington State sales tax.

H. "Contract Time" is the number of calendar days allotted in the Contract Documents for achieving Substantial Completion of the Work.

I. "Contractor" means the person or entity who has agreed with Owner to perform the Work in accordance with the Contract Documents.

J. "Day(s): Unless otherwise specified, day(s) shall mean calendar day(s)."

K. "Drawings" are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, and may include plans, elevations, sections, details, schedules, and diagrams.

L. "Final Acceptance" means the written acceptance issued to Contractor by Owner after Contractor has completed the requirements of the Contract Documents, as more fully set forth in Section 6.09 B.

M. "Final Completion" means that the Work is fully and finally complete in accordance with the Contract Documents, as more fully set forth in Section 6.09 A.

N. "Force Majeure" means those acts entitling Contractor to request an equitable adjustment in the Contract Time, as more fully set forth in paragraph 3.05A.

O. "Notice" means a written notice which has been delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended or, if delivered or sent by registered or certified mail, to the last business address known to the party giving notice.

P. "Notice to Proceed" means a notice from Owner to Contractor that defines the date on which the Contract Time begins to run.

Q. "Owner" means the state agency, institution, or its authorized representative with the authority to enter into, administer, and/or terminate the Work in accordance with the Contract Documents and make related determinations and findings.

R. "Person" means a corporation, partnership, business association of any kind, trust, company, or individual.

S. "Prior Occupancy" means Owner's use of all or parts of the Project before Substantial Completion, as more fully set forth in Section 6.08 A.

T. "Progress Schedule" means a schedule of the Work, in a form satisfactory to Owner, as further set forth in Section 3.02.

U. "Project" means the total construction of which the Work performed in accordance with the Contract Documents may be the whole or a part and which may include construction by Owner or by separate contractors.

V. "Project Record" means the separate set of Drawings and Specifications as further set forth in paragraph 4.02A.

W. "Schedule of Values" means a written breakdown allocating the total Contract Sum to each principal category of Work, in such detail as requested by Owner.

X. "Specifications" are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

Y. "Subcontract" means a contract entered into by Subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind for or in connection with the Work.

Z. "Subcontractor" means any person, other than Contractor, who agrees to furnish or furnishes any supplies, materials, equipment, or services of any kind in connection with the Work.

AA. "Substantial Completion" means that stage in the progress of the Work when the construction is sufficiently complete, as more fully set forth in Section 6.07.

AB. "Work" means the construction and services required by the Contract Documents, and includes, but is not limited to, labor, materials, supplies, equipment, services, permits, and the manufacture and fabrication of components, performed, furnished, or provided in accordance with the Contract Documents.

1.02 ORDER OF PRECEDENCE

Any conflict or inconsistency in the Contract Documents shall be resolved by giving the documents precedence in the following order:

1. Signed Public Works Contract, including any Change Orders.

2. Supplemental Conditions.

3. Modifications to the General Conditions.

4. General Conditions.

5. Specifications. Provisions in Division 1 shall take precedence over provisions of any other Division.

6. Drawings. In case of conflict within the Drawings, large scale drawings shall take precedence over small scale drawings.

7. Signed and Completed Bid Form.

8. Instructions to Bidders.

9. Advertisement for Bids.

1.03 EXECUTION AND INTENT

Contractor Representations: Contractor makes the following representations to Owner:

1. Contract Sum reasonable: The Contract Sum is reasonable compensation for the Work and the Contract Time is adequate for the performance of the Work, as represented by the Contract Documents;

2. Contractor familiar with project: Contractor has carefully reviewed the Contract Documents, visited and examined the Project site, become familiar with the local conditions in which the Work is to be performed, and satisfied itself as to the nature, location, character, quality and quantity of the Work, the labor, materials, equipment, goods, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface and subsurface conditions and other matters that may be encountered at the Project site or affect performance of the Work or the cost or difficulty thereof;

3. Contractor financially capable: Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete the Work and perform Contractor's obligations required by the Contract Documents; and

4. Contractor can complete Work: Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform the obligations required by the Contract Documents and has sufficient experience and competence to do so.

PART 2 – INSURANCE AND BONDS

2.01 CONTRACTOR'S LIABILITY INSURANCE

General insurance requirements: Prior to commencement of the Work, Contractor shall obtain all the insurance required by the Contract Documents and provide evidence satisfactory to Owner that such insurance has been procured. Review of the Contractor's insurance by Owner shall not relieve or decrease the liability of Contractor. Companies writing the insurance to be obtained by this part shall be licensed to do business under Chapter 48 RCW or comply with the Surplus Lines Law of the State of Washington. Contractor shall include in its bid the cost of all insurance and bond costs required to complete the base bid work and accepted alternates. Insurance carriers providing insurance in accordance with the Contract Documents shall be acceptable to Owner, and its A.M. Best rating shall be indicated on the insurance certificates.

A. Term of insurance coverage: Contractor shall maintain the following insurance coverage during the Work and for one year after Final Acceptance. Contractor shall also maintain the following insurance coverage during the performance of any corrective Work required by Section 5.16.

1. General Liability Insurance: Commercial General Liability (CGL) on an Occurrence Form. Coverage shall include, but not be limited to:

   a. Completed operations/products liability;

   b. Explosion, collapse, and underground; and

   c. Employer's liability coverage.

2. Automobile Liability Insurance: Automobile liability

B. Industrial Insurance compliance: Contractor shall comply with the Washington State Industrial Insurance Act and, if applicable, the Federal Longshoremen's and Harbor Workers' Act and the Jones Act.

C. Insurance to protect for the following: All insurance coverages shall protect against claims for damages for personal and bodily injury or death, as well as claims for property damage, which may arise from operations in connection with the Work whether such operations are by Contractor or any Subcontractor.

D. Owner as Additional Insured: All insurance coverages shall be endorsed to include Owner as an additional named insured for Work performed in accordance with the Contract Documents, and all insurance certificates shall evidence the Owner as an additional insured.

2.02 COVERAGE LIMITS

Insurance amounts: The coverage limits shall be as follows:

A. Limits of Liability shall not be less than $1,000,000 Combined Single Limit for Bodily Injury and Property Damage (other than Automobile Liability) Each Occurrence; Personal Injury and Advertising Liability Each Occurrence.

B. $2,000,000 Combined Single Limit Annual General Aggregate.

C. $2,000,000 Annual Aggregate for Products and Completed Operations Liability.

D. $1,000,000 Combined Single Limit for Automobile Bodily Injury and Property Damage Liability, Each Accident or Loss.

2.03 INSURANCE COVERAGE CERTIFICATES

A. Certificate required: Prior to commencement of the Work, Contractor shall furnish to Owner a completed certificate of insurance coverage.

B. List Project info: All insurance certificates shall name Owner's Project number and Project title.

C. Cancellation provisions: All insurance certificates shall specifically require 45 Days prior notice to Owner of cancellation or any material change, except 30 Days for surplus line insurance.

2.04 PAYMENT AND PERFORMANCE BONDS

Conditions for bonds: Payment and performance bonds for 100% of the Contract Award Amount, plus state sales tax, shall be furnished for the Work, using the Payment Bond and Performance Bond form published by and available from the American Institute of Architects (AIA) – form A312. Prior to execution of a Change Order that, cumulatively with previous Change Orders, increases the Contract Award Amount by 15% or more, the Contractor shall provide either new payment and performance bonds for the

revised Contract Sum, or riders to the existing payment and performance bonds increasing the amount of the bonds. The Contractor shall likewise provide additional bonds or riders when subsequent Change Orders increase the Contract Sum by 15% or more. No payment or performance bond is required if the Contract Sum is $35,000 or less and Contractor agrees that Owner may, in lieu of the bond, retain 50% of the Contract Sum for the period allowed by RCW 39.08.010.

2.05 ALTERNATIVE SURETY

When alternative surety required: Contractor shall promptly furnish payment and performance bonds from an alternative surety as required to protect Owner and persons supplying labor or materials required by the Contract Documents if:

A. Owner has a reasonable objection to the surety; or

B. Any surety fails to furnish reports on its financial condition if required by Owner.

2.06 BUILDER'S RISK

A. Contractor to buy Property Insurance: Contractor shall purchase and maintain property insurance in the amount of the Contract Sum including all Change Orders for the Work on a replacement cost basis until Substantial Completion. For projects not involving New Building Construction, "Installation Floater" is an acceptable substitute for the Builder's Risk Insurance. The insurance shall cover the interest of Owner, Contractor, and any Subcontractors, as their interests may appear.

B. Losses covered: Contractor property insurance shall be placed on an "all risk" basis and insure against the perils of fire and extended coverage and physical loss or damage including theft, vandalism, malicious mischief, collapse, false work, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for A/E's services and expenses required as a result of an insured loss.

C. Waiver of subrogation rights: Owner and Contractor waive all subrogation rights against each other, any Subcontractors, A/E, A/E's subconsultants, separate contractors described in Section 5.20, if any, and any of their subcontractors, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this section or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by Owner as fiduciary. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

PART 3 – TIME AND SCHEDULE

3.01 PROGRESS AND COMPLETION

Contractor to meet schedule: Contractor shall diligently prosecute the Work, with adequate forces, achieve Substantial Completion within the Contract Time, and achieve Final Completion within a reasonable period thereafter.

3.02 CONSTRUCTION SCHEDULE

A. Preliminary Progress Schedule: Unless otherwise provided in Division 1, Contractor shall, within 14 Days after issuance of the Notice to Proceed, submit a preliminary Progress Schedule. The Progress Schedule shall show the sequence in which Contractor proposes to perform the Work,

and the dates on which Contractor plans to start and finish major portions of the Work, including dates for shop drawings and other submittals, and for acquiring materials and equipment.

B. Form of Progress Schedule: Unless otherwise provided in Division 1, the Progress Schedule shall be in the form of a bar chart, or a critical path method analysis, as specified by Owner. The preliminary Progress Schedule may be general, showing the major portions of the Work, with a more detailed Progress Schedule submitted as directed by Owner.

C. Owner comments on Progress Schedule: Owner shall return comments on the preliminary Progress Schedule to Contractor within 14 Days of receipt. Review by Owner of Contractor's schedule does not constitute an approval or acceptance of Contractor's construction means, methods, or sequencing, or its ability to complete the Work within the Contract Time. Contractor shall revise and resubmit its schedule, as necessary. Owner may withhold a portion of progress payments until a Progress Schedule has been submitted which meets the requirements of this section.

D. Monthly updates and compliance with Progress Schedule: Contractor shall utilize and comply with the Progress Schedule. On a monthly basis, or as otherwise directed by Owner, Contractor shall submit an updated Progress Schedule at its own expense to Owner indicating actual progress. If, in the opinion of Owner, Contractor is not in conformance with the Progress Schedule for reasons other than acts of Force Majeure as identified in Section 3.05, Contractor shall take such steps as are necessary to bring the actual completion dates of its work activities into conformance with the Progress Schedule, and if directed by Owner, Contractor shall submit a corrective action plan or revise the Progress Schedule to reconcile with the actual progress of the Work.

E. Contractor to notify Owner of delays: Contractor shall promptly notify Owner in writing of any actual or anticipated event which is delaying or could delay achievement of any milestone or performance of any critical path activity of the Work. Contractor shall indicate the expected duration of the delay, the anticipated effect of the delay on the Progress Schedule, and the action being or to be taken to correct the problem. Provision of such notice does not relieve Contractor of its obligation to complete the Work within the Contract Time.

3.03 OWNER'S RIGHT TO SUSPEND THE WORK FOR CONVENIENCE

A. Owner may suspend Work: Owner may, at its sole discretion, order Contractor, in writing, to suspend all or any part of the Work for up to 90 Days, or for such longer period as mutually agreed.

B. Compliance with suspension; Owner's options: Upon receipt of a written notice suspending the Work, Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of cost of performance directly attributable to such suspension. Within a period up to 90 Days after the notice is delivered to Contractor, or within any extension of that period to which the parties shall have agreed, Owner shall either:

1. Cancel the written notice suspending the Work; or

2. Terminate the Work covered by the notice as provided in the termination provisions of Part 9.

C. Resumption of Work: If a written notice suspending the Work is cancelled or the period of the notice or any extension thereof expires, Contractor shall resume Work.

D. Equitable Adjustment for suspensions: Contractor shall be entitled to an equitable adjustment in the Contract Time, or Contract Sum, or both, for increases in the time or cost of performance

directly attributable to such suspension, provided Contractor complies with all requirements set forth in Part 7.

3.04 OWNER'S RIGHT TO STOP THE WORK FOR CAUSE

A. Owner may stop Work for Contractor's failure to perform: If Contractor fails or refuses to perform its obligations in accordance with the Contract Documents, Owner may order Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken.

B. No Equitable Adjustment for Contractor's failure to perform: Contractor shall not be entitled to an equitable adjustment in the Contract Time or Contract Sum for any increased cost or time of performance attributable to Contractor's failure or refusal to perform or from any reasonable remedial action taken by Owner based upon such failure.

3.05 DELAY

A. Force Majeure actions not a default; Force Majeure defined: Any delay in or failure of performance by Owner or Contractor, other than the payment of money, shall not constitute a default hereunder if and to the extent the cause for such delay or failure of performance was unforeseeable and beyond the control of the party ("Force Majeure"). Acts of Force Majeure include, but are not limited to:

1. Acts of God or the public enemy;

2. Acts or omissions of any government entity;

3. Fire or other casualty for which Contractor is not responsible;

4. Quarantine or epidemic;

5. Strike or defensive lockout;

6. Unusually severe weather conditions which could not have been reasonably anticipated; and

7. Unusual delay in receipt of supplies or products which were ordered and expedited and for which no substitute reasonably acceptable to Owner was available.

B. Contract Time adjustment for Force Majeure: Contractor shall be entitled to an equitable adjustment in the Contract Time for changes in the time of performance directly attributable to an act of Force Majeure, provided it makes a request for equitable adjustment according to Section 7.03. Contractor shall not be entitled to an adjustment in the Contract Sum resulting from an act of Force Majeure.

C. Contract Time or Contract Sum adjustment if Owner at fault: Contractor shall be entitled to an equitable adjustment in Contract Time, and may be entitled to an equitable adjustment in Contract Sum, if the cost or time of Contractor's performance is changed due to the fault or negligence of Owner, provided the Contractor makes a request according to Sections 7.02 and 7.03.

D. No Contract Time or Contract Sum adjustment if Contractor at fault: Contractor shall not be entitled to an adjustment in Contract Time or in the Contract Sum for any delay or failure of performance to the extent such delay or failure was caused by Contractor or anyone for whose acts Contractor is responsible.

E. Contract Time adjustment only for concurrent fault: To the extent any delay or failure of performance was concurrently caused by the Owner and Contractor, Contractor shall be entitled to an adjustment in the Contract Time for that portion of the delay or failure of performance that was concurrently caused, provided it makes a request for equitable adjustment according to Section 7.03, but shall not be entitled to an adjustment in Contract Sum.

F. Contractor to mitigate delay impacts: Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay, whether occasioned by an act of Force Majeure or otherwise.

3.06 NOTICE TO OWNER OF LABOR DISPUTES

A. Contractor to notify Owner of labor disputes: If Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay timely performance in accordance with the Contract Documents, Contractor shall immediately give notice, including all relevant information, to Owner.

B. Pass through notification provisions to Subcontractors: Contractor agrees to insert a provision in its Subcontracts and to require insertion in all sub-subcontracts, that in the event timely performance of any such contract is delayed or threatened by delay by any actual or potential labor dispute, the Subcontractor or Sub-subcontractor shall immediately notify the next higher tier Subcontractor or Contractor, as the case may be, of all relevant information concerning the dispute.

3.07 DAMAGES FOR FAILURE TO ACHIEVE TIMELY COMPLETION

A. Liquidated Damages

1. Reason for Liquidated Damages: Timely performance and completion of the Work is essential to Owner and time limits stated in the Contract Documents are of the essence. Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. However, it would be difficult if not impossible to determine the exact amount of such damages. Consequently, provisions for liquidated damages are included in the Contract Documents.

2. Calculation of Liquidated Damages amount: The liquidated damage amounts set forth in the Contract Documents will be assessed not as a penalty, but as liquidated damages for breach of the Contract Documents. This amount is fixed and agreed upon by and between the Contractor and Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. This amount shall be construed as the actual amount of damages sustained by the Owner, and may be retained by the Owner and deducted from periodic payments to the Contractor.

3. Contractor responsible even if Liquidated Damages assessed: Assessment of liquidated damages shall not release Contractor from any further obligations or liabilities pursuant to the Contract Documents.

B. Actual Damages

Calculation of Actual Damages: Actual damages will be assessed for failure to achieve Final Completion within the time provided. Actual damages will be calculated on the basis of direct architectural, administrative, and other related costs attributable to the Project from the date when Final Completion should have been achieved, based on the date Substantial Completion is actually achieved, to the date Final Completion is actually achieved. Owner may offset these costs against any payment due Contractor.

PART 4 – SPECIFICATIONS, DRAWINGS, AND OTHER DOCUMENTS

4.01 DISCREPANCIES AND CONTRACT DOCUMENT REVIEW

A. Specifications and Drawings are basis of the Work: The intent of the Specifications and Drawings is to describe a complete Project to be constructed in accordance with the Contract Documents. Contractor shall furnish all labor, materials, equipment, tools, transportation, permits, and supplies, and perform the Work required in accordance with the Drawings, Specifications, and other provisions of the Contract Documents.

B. Parts of the Contract Documents are complementary: The Contract Documents are complementary. What is required by one part of the Contract Documents shall be binding as if required by all. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both.

C. Contractor to report discrepancies in Contract Documents: Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by Owner. If, during the performance of the Work, Contractor finds a conflict, error, inconsistency, or omission in the Contract Documents, it shall promptly and before proceeding with the Work affected thereby, report such conflict, error, inconsistency, or omission to A/E in writing.

D. Contractor knowledge of discrepancy in documents – responsibility: Contractor shall do no Work without applicable Drawings, Specifications, or written modifications, or Shop Drawings where required, unless instructed to do so in writing by Owner. If Contractor performs any construction activity, and it knows or reasonably should have known that any of the Contract Documents contain a conflict, error, inconsistency, or omission, Contractor shall be responsible for the performance and shall bear the cost for its correction.

E. Contractor to perform Work implied by Contract Documents: Contractor shall provide any work or materials the provision of which is clearly implied and is within the scope of the Contract Documents even if the Contract Documents do not mention them specifically.

F. Interpretation questions referred to A/E: Questions regarding interpretation of the requirements of the Contract Documents shall be referred to the A/E.

4.02 PROJECT RECORD

A. Contractor to maintain Project Record Drawings and Specifications: Contractor shall legibly mark in ink on a separate set of the Drawings and Specifications all actual construction, including depths of foundations, horizontal and vertical locations of internal and underground utilities and appurtenances referenced to permanent visible and accessible surface improvements, field changes of dimensions and details, actual suppliers, manufacturers and trade names, models of installed equipment, and Change Order Proposals (COP). This separate set of Drawings and Specifications shall be the “Project Record.”

B. Update Project Record weekly and keep on site: The Project Record shall be maintained on the project site throughout the construction and shall be clearly labeled “PROJECT RECORD.” The Project Record shall be updated at least weekly noting all changes and shall be available to Owner at all times.

C. Final Project Record to A/E before Final Acceptance: Contractor shall submit the completed and finalized Project Record to A/E prior to Final Acceptance.

4.03 SHOP DRAWINGS

A. Definition of Shop Drawings: "Shop Drawings" means documents and other information required to be submitted to A/E by Contractor pursuant to the Contract Documents, showing in detail: the proposed fabrication and assembly of structural elements; and the installation (i.e. form, fit, and attachment details) of materials and equipment. Shop Drawings include, but are not limited to, drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials furnished by Contractor to explain in detail specific portions of the Work required by the Contract Documents. For materials and equipment to be incorporated into the Work, Contractor submittal shall include the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the item. When directed, Contractor shall submit all samples at its own expense. Owner may duplicate, use, and disclose Shop Drawings provided in accordance with the Contract Documents.

B. Approval of Shop Drawings by Contractor and A/E: Contractor shall coordinate all Shop Drawings, and review them for accuracy, completeness, and compliance with the Contract Documents and shall indicate its approval thereon as evidence of such coordination and review. Where required by law, Shop Drawings shall be stamped by an appropriate professional licensed by the state of Washington. Shop Drawings submitted to A/E without evidence of Contractor's approval shall be returned for resubmission. Contractor shall review, approve, and submit Shop Drawings with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Owner or separate contractors. Contractor's submittal schedule shall allow a reasonable time for A/E review. A/E will review, approve, or take other appropriate action on the Shop Drawings. Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings until the respective submittal has been reviewed and the A/E has approved or taken other appropriate action. Owner and A/E shall respond to Shop Drawing submittals with reasonable promptness. Any Work by Contractor shall be in accordance with reviewed Shop Drawings. Submittals made by Contractor which are not required by the Contract Documents may be returned without action.

C. Contractor not relieved of responsibility when Shop Drawings approved: Approval, or other appropriate action with regard to Shop Drawings, by Owner or A/E shall not relieve Contractor of responsibility for any errors or omissions in such Shop Drawings, nor from responsibility for compliance with the requirements of the Contract Documents. Unless specified in the Contract Documents, review by Owner or A/E shall not constitute an approval of the safety precautions employed by Contractor during construction, or constitute an approval of Contractor's means or methods of construction. If Contractor fails to obtain approval before installation and the item or work is subsequently rejected, Contractor shall be responsible for all costs of correction.

D. Variations between Shop Drawings and Contract Documents: If Shop Drawings show variations from the requirements of the Contract Documents, Contractor shall describe such variations in writing, separate from the Shop Drawings, at the time it submits the Shop Drawings containing such variations. If A/E approves any such variation, an appropriate Change Order will be issued. If the variation is minor and does not involve an adjustment in the Contract Sum or Contract Time, a Change Order need not be issued; however, the modification shall be recorded upon the Project Record.

E. Contractor to submit 5 copies of Shop Drawings: Unless otherwise provided in Division 1, Contractor shall submit to A/E for approval 5 copies of all Shop Drawings. Unless otherwise indicated, 3 sets of all Shop Drawings shall be retained by A/E and 2 sets shall be returned to Contractor.

4.04 ORGANIZATION OF SPECIFICATIONS

Specification organization by trade: Specifications are prepared in sections which conform generally with trade practices. These sections are for Owner and Contractor convenience and shall not control Contractor in dividing the Work among the Subcontractors or in establishing the extent of the Work to be performed by any trade.

4.05 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER DOCUMENTS

A. A/E, not Contractor, owns Copyright of Drawings and Specifications: The Drawings, Specifications, and other documents prepared by A/E are instruments of A/E's service through which the Work to be executed by Contractor is described. Neither Contractor nor any Subcontractor shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by A/E, and A/E shall be deemed the author of them and will, along with any rights of Owner, retain all common law, statutory, and other reserved rights, in addition to the copyright. All copies of these documents, except Contractor's set, shall be returned or suitably accounted for to A/E, on request, upon completion of the Work.

B. Drawings and Specifications to be used only for this Project: The Drawings, Specifications, and other documents prepared by the A/E, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner and A/E. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by A/E appropriate to and for use in the execution of their Work.

C. Shop Drawing license granted to Owner: Contractor and all Subcontractors grant a non-exclusive license to Owner, without additional cost or royalty, to use for its own purposes (including reproduction) all Shop Drawings, together with the information and diagrams contained therein, prepared by Contractor or any Subcontractor. In providing Shop Drawings, Contractor and all Subcontractors warrant that they have authority to grant to Owner a license to use the Shop Drawings, and that such license is not in violation of any copyright or other intellectual property right. Contractor agrees to defend and indemnify Owner pursuant to the indemnity provisions in Section 5.03 and 5.22 from any violations of copyright or other intellectual property rights arising out of Owner's use of the Shop Drawings hereunder, or to secure for Owner, at Contractor's own cost, licenses in conformity with this section.

D. Shop Drawings to be used only for this Project: The Shop Drawings and other submittals prepared by Contractor, Subcontractors of any tier, or its or their equipment or material suppliers, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor of any tier, or material or equipment supplier, on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner. The Contractor, Subcontractors of any tier, and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Shop Drawings and other submittals appropriate to and for use in the execution of their Work under the Contract Documents.

PART 5 – PERFORMANCE

5.01 CONTRACTOR CONTROL AND SUPERVISION

A. Contractor responsible for Means and Methods of construction: Contractor shall supervise and direct the Work, using its best skill and attention, and shall perform the Work in a skillful manner. Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work, unless the

Contract Documents give other specific instructions concerning these matters. Contractor shall disclose its means and methods of construction when requested by Owner.

B. Competent Superintendent required: Performance of the Work shall be directly supervised by a competent superintendent who has authority to act for Contractor. The superintendent must be satisfactory to the Owner and shall not be changed without the prior written consent of Owner. Owner may require Contractor to remove the superintendent from the Work or Project site, if Owner reasonably deems the superintendent incompetent, careless, or otherwise objectionable, provided Owner has first notified Contractor in writing and allowed a reasonable period for transition.

C. Contractor responsible for acts and omissions of self and agents: Contractor shall be responsible to Owner for acts and omissions of Contractor, Subcontractors, and their employees and agents.

D. Contractor to employ competent and disciplined workforce: Contractor shall enforce strict discipline and good order among all of the Contractor's employees and other persons performing the Work. Contractor shall not permit employment of persons not skilled in tasks assigned to them. Contractor's employees shall at all times conduct business in a manner which assures fair, equal, and nondiscriminatory treatment of all persons. Owner may, by written notice, request Contractor to remove from the Work or Project site any employee Owner reasonably deems incompetent, careless, or otherwise objectionable.

E. Contractor to keep project documents on site: Contractor shall keep on the Project site a copy of the Drawings, Specifications, addenda, reviewed Shop Drawings, and permits and permit drawings.

F. Contractor to comply with ethical standards: Contractor shall ensure that its owner(s) and employees, and those of its Subcontractors, comply with the Ethics in Public Service Act RCW 42.52, which, among other things, prohibits state employees from having an economic interest in any public works contract that was made by, or supervised by, that employee. Contractor shall remove, at its sole cost and expense, any of its, or its Subcontractors' employees, if they are in violation of this act.

5.02 PERMITS, FEES, AND NOTICES

A. Contractor to obtain and pay for permits: Unless otherwise provided in the Contract Documents, Contractor shall pay for and obtain all permits, licenses, and inspections necessary for proper execution and completion of the Work. Prior to Final Acceptance, the approved, signed permits shall be delivered to Owner.

B. Allowances for permit fees: If allowances for permits or utility fees are called for in the Contract Documents and set forth in Contractor's bid, and the actual costs of those permits or fees differ from the allowances in the Contract Documents, the difference shall be adjusted by Change Order.

C. Contractor to comply with all applicable laws: Contractor shall comply with and give notices required by all federal, state, and local laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

5.03 PATENTS AND ROYALTIES

Payment, indemnification, and notice: Contractor is responsible for, and shall pay, all royalties and license fees. Contractor shall defend, indemnify, and hold Owner harmless from any costs, expenses, and liabilities arising out of the infringement by Contractor of any patent, copyright, or other intellectual property right used in the Work; however, provided that Contractor gives prompt notice, Contractor shall not be responsible for such defense or indemnity when a particular design, process, or product of a

particular manufacturer or manufacturers is required by the Contract Documents. If Contractor has reason to believe that use of the required design, process, or product constitutes an infringement of a patent or copyright, it shall promptly notify Owner of such potential infringement.

5.04 PREVAILING WAGES

A. Contractor to pay Prevailing Wages: Contractor shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work, is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor's responsibility to verify the applicable prevailing wage rate.

B. Statement of Intent to Pay Prevailing Wages: Before payment is made by the Owner to the Contractor for any work performed by the Contractor and subcontractors whose work is included in the application for payment, the Contractor shall submit, or shall have previously submitted to the Owner for the Project, a Statement of Intent to Pay Prevailing Wages, approved by the Department of Labor and Industries, certifying the rate of hourly wage paid and to be paid each classification of laborers, workers, or mechanics employed upon the Work by Contractor and Subcontractors. Such rates of hourly wage shall not be less than the prevailing wage rate.

C. Affidavit of Wages Paid: Prior to release of retainage, the Contractor shall submit to the Owner an Affidavit of Wages Paid, approved by the Department of Labor and Industries, for the Contractor and every subcontractor, of any tier, that performed work on the Project.

D. Disputes: Disputes regarding prevailing wage rates shall be referred for arbitration to the Director of the Department of Labor and Industries. The arbitration decision shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060.

E. Statement with pay application; Post Statements of Intent at job site: Each Application for Payment submitted by Contractor shall state that prevailing wages have been paid in accordance with the prefiled statement(s) of intent, as approved. Copies of the approved intent statement(s) shall be posted on the job site with the address and telephone number of the Industrial Statistician of the Department of Labor and Industries where a complaint or inquiry concerning prevailing wages may be made.

F. Contractor to pay for Statements of Intent and Affidavits: In compliance with chapter 296-127 WAC, Contractor shall pay to the Department of Labor and Industries the currently established fee(s) for each statement of intent and/or affidavit of wages paid submitted to the Department of Labor and Industries for certification.

G. Certified Payrolls: Consistent with WAC 296-127-320, the Contractor and any subcontractor shall submit a certified copy of payroll records if requested.

5.05 HOURS OF LABOR

A. Overtime: Contractor shall comply with all applicable provisions of RCW 49.28 and they are incorporated herein by reference. Pursuant to that statute, no laborer, worker, or mechanic employed by Contractor, any Subcontractor, or any other person performing or contracting to do the whole or any part of the Work, shall be permitted or required to work more than eight hours in any one calendar day, provided, that in cases of extraordinary emergency, such as danger to life or property, the hours of work may be extended, but in such cases the rate of pay for time employed in excess of eight hours of each calendar day shall be not less than one and one-half times the rate allowed for this same amount of time during eight hours of service.

B. 4-10 Agreements: Notwithstanding the preceding paragraph, RCW 49.28 permits a contractor or subcontractor in any public works contract subject to those provisions, to enter into an agreement with its employees in which the employees work up to ten hours in a calendar day. No such agreement may provide that the employees work ten-hour days for more than four calendar days a week. Any such agreement is subject to approval by the employees. The overtime provisions of RCW 49.28 shall not apply to the hours, up to forty hours per week, worked pursuant to any such agreement.

5.06 NONDISCRIMINATION

A. Discrimination prohibited by applicable laws: Discrimination in all phases of employment is prohibited by, among other laws and regulations, Title VII of the Civil Rights Act of 1964, the Vietnam Era Veterans Readjustment Act of 1974, Sections 503 and 504 of the Vocational Rehabilitation Act of 1973, the Equal Employment Act of 1972, the Age Discrimination Act of 1967, the Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, Presidential Executive Order 11246, Executive Order 11375, the Washington State Law Against Discrimination, RCW 49.60, and Gubernatorial Executive Order 85-09. These laws and regulations establish minimum requirements for affirmative action and fair employment practices which Contractor must meet.

B. During performance of the Work:

1. Protected Classes: Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability, Vietnam era veteran status, or disabled veteran status, nor commit any other unfair practices as defined in RCW 49.60.

2. Advertisements to state nondiscrimination: Contractor shall, in all solicitations or advertisements for employees placed by or for it, state that all qualified applicants will be considered for employment, without regard to race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability.

3. Contractor to notify unions and others of nondiscrimination: Contractor shall send to each labor union, employment agency, or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union, employment agency, or workers' representative of Contractor's obligations according to the Contract Documents and RCW 49.60.

4. Owner and State access to Contractor records: Contractor shall permit access to its books, records, and accounts, and to its premises by Owner, and by the Washington State Human Rights Commission, for the purpose of investigation to ascertain compliance with this section of the Contract Documents.

5. Pass through provisions to Subcontractors: Contractor shall include the provisions of this section in every Subcontract.

5.07 SAFETY PRECAUTIONS

A. Contractor responsible for safety: Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work.

B. Contractor safety responsibilities: In carrying out its responsibilities according to the Contract Documents, Contractor shall protect the lives and health of employees performing the Work and other persons who may be affected by the Work; prevent damage to materials, supplies, and equipment whether on site or stored off-site; and prevent damage to other property at the site or adjacent thereto. Contractor shall comply with all applicable laws, ordinances, rules, regulations,

and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss; shall erect and maintain all necessary safeguards for such safety and protection; and shall notify owners of adjacent property and utilities when prosecution of the Work may affect them.

C. Contractor to maintain safety records: Contractor shall maintain an accurate record of exposure data on all incidents relating to the Work resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment. Contractor shall immediately report any such incident to Owner. Owner shall, at all times, have a right of access to all records of exposure.

D. Contractor to provide HazMat training: Contractor shall provide all persons working on the Project site with information and training on hazardous chemicals in their work at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

1. Information. At a minimum, Contractor shall inform persons working on the Project site of:

a. WAC: The requirements of chapter 296-62 WAC, General Occupational Health Standards;

b. Presence of hazardous chemicals: Any operations in their work area where hazardous chemicals are present; and

c. Hazard communications program: The location and availability of written hazard communication programs, including the required list(s) of hazardous chemicals and material safety data sheets required by chapter 296-62 WAC.

2. Training. At a minimum, Contractor shall provide training for persons working on the Project site which includes:

a. Detecting hazardous chemicals: Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

b. Hazards of chemicals: The physical and health hazards of the chemicals in the work area;

c. Protection from hazards: The measures such persons can take to protect themselves from these hazards, including specific procedures Contractor, or its Subcontractors, or others have implemented to protect those on the Project site from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and

d. Hazard communications program: The details of the hazard communications program developed by Contractor, or its Subcontractors, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

E. Hazardous, toxic or harmful substances: Contractor's responsibility for hazardous, toxic, or harmful substances shall include the following duties:

1. Illegal use of dangerous substances: Contractor shall not keep, use, dispose, transport, generate, or sell on or about the Project site, any substances now or hereafter designated as, or which are subject to regulation as, hazardous, toxic, dangerous, or

harmful by any federal, state or local law, regulation, statute or ordinance (hereinafter collectively referred to as "hazardous substances"), in violation of any such law, regulation, statute, or ordinance, but in no case shall any such hazardous substance be stored more than 90 Days on the Project site.

2. Contractor notifications of spills, failures, inspections, and fines: Contractor shall promptly notify Owner of all spills or releases of any hazardous substances which are otherwise required to be reported to any regulatory agency and pay the cost of cleanup. Contractor shall promptly notify Owner of all failures to comply with any federal, state, or local law, regulation, or ordinance; all inspections of the Project site by any regulatory entity concerning the same; all regulatory orders or fines; and all responses or interim cleanup actions taken by or proposed to be taken by any government entity or private party on the Project site.

F. Public safety and traffic: All Work shall be performed with due regard for the safety of the public. Contractor shall perform the Work so as to cause a minimum of interruption of vehicular traffic or inconvenience to pedestrians. All arrangements to care for such traffic shall be Contractor's responsibilities. All expenses involved in the maintenance of traffic by way of detours shall be borne by Contractor.

G. Contractor to act in an emergency: In an emergency affecting the safety of life or the Work or of adjoining property, Contractor is permitted to act, at its discretion, to prevent such threatened loss or injury, and Contractor shall so act if so authorized or instructed.

H. No duty of safety by Owner or A/E: Nothing provided in this section shall be construed as imposing any duty upon Owner or A/E with regard to, or as constituting any express or implied assumption of control or responsibility over, Project site safety, or over any other safety conditions relating to employees or agents of Contractor or any of its Subcontractors, or the public.

5.08 OPERATIONS, MATERIAL HANDLING, AND STORAGE AREAS

A. Limited storage areas: Contractor shall confine all operations, including storage of materials, to Owner-approved areas.

B. Temporary buildings and utilities at Contractor expense: Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be provided by Contractor only with the consent of Owner and without expense to Owner. The temporary buildings and utilities shall be removed by Contractor at its expense upon completion of the Work.

C. Roads and vehicle loads: Contractor shall use only established roadways or temporary roadways authorized by Owner. When materials are transported in prosecuting the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by federal, state, or local law or regulation.

D. Ownership and reporting by Contractor of demolished materials: Ownership and control of all materials or facility components to be demolished or removed from the Project site by Contractor shall immediately vest in Contractor upon severance of the component from the facility or severance of the material from the Project site. Contractor shall be responsible for compliance with all laws governing the storage and ultimate disposal. Contractor shall provide Owner with a copy of all manifests and receipts evidencing proper disposal when required by Owner or applicable law.

E. Contractor responsible for care of materials and equipment on-site: Contractor shall be responsible for the proper care and protection of its materials and equipment delivered to the Project site. Materials and equipment may be stored on the premises subject to approval of

Owner. When Contractor uses any portion of the Project site as a shop, Contractor shall be responsible for any repairs, patching, or cleaning arising from such use.

F. Contractor responsible for loss of materials and equipment: Contractor shall protect and be responsible for any damage or loss to the Work, or to the materials or equipment until the date of Substantial Completion, and shall repair or replace without cost to Owner any damage or loss that may occur, except damages or loss caused by the acts or omissions of Owner. Contractor shall also protect and be responsible for any damage or loss to the Work, or to the materials or equipment, after the date of Substantial Completion, and shall repair or replace without cost to Owner any such damage or loss that might occur, to the extent such damages or loss are caused by the acts or omissions of Contractor, or any Subcontractor.

5.09 PRIOR NOTICE OF EXCAVATION

A. Excavation defined; Use of locator services: "Excavation" means an operation in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means, except the tilling of soil less than 12 inches in depth for agricultural purposes, or road ditch maintenance that does not change the original road grade or ditch flow line. Before commencing any excavation, Contractor shall provide notice of the scheduled commencement of excavation to all owners of underground facilities or utilities, through locator services.

5.10 UNFORESEEN PHYSICAL CONDITIONS

A. Notice requirement for concealed or unknown conditions: If Contractor encounters conditions at the site which are subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then Contractor shall give written notice to Owner promptly and in no event later than 7 Days after the first observance of the conditions. Conditions shall not be disturbed prior to such notice.

B. Adjustment in Contract Time and Contract Sum: If such conditions differ materially and cause a change in Contractor's cost of, or time required for, performance of any part of the Work, the Contractor may be entitled to an equitable adjustment in the Contract Time or Contract Sum, or both, provided it makes a request therefore as provided in Part 7.

5.11 PROTECTION OF EXISTING STRUCTURES, EQUIPMENT, VEGETATION, UTILITIES AND IMPROVEMENTS

A. Contractor to protect and repair property: Contractor shall protect from damage all existing structures, equipment, improvements, utilities, and vegetation: at or near the Project site; and on adjacent property of a third party, the locations of which are made known to or should be known by Contractor. Contractor shall repair any damage, including that to the property of a third party, resulting from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly, Owner may have the necessary work performed and charge the cost to Contractor.

B. Tree and vegetation protection: Contractor shall only remove trees when specifically authorized to do so, and shall protect vegetation that will remain in place.

5.12 LAYOUT OF WORK

A. Advanced planning of the Work: Contractor shall plan and lay out the Work in advance of operations so as to coordinate all work without delay or revision.

B. Layout responsibilities: Contractor shall lay out the Work from Owner-established baselines and bench marks indicated on the Drawings, and shall be responsible for all field measurements in connection with the layout. Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work. Contractor shall be responsible for executing the Work to the lines and grades that may be established. Contractor shall be responsible for maintaining or restoring all stakes and other marks established.

5.13 MATERIAL AND EQUIPMENT

A. Contractor to provide new and equivalent equipment and materials: All equipment, material, and articles incorporated into the Work shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in the Contract Documents. References in the Specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard quality and shall not be construed as limiting competition. Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of A/E, is equal to that named in the specifications, unless otherwise specifically provided in the Contract Documents.

B. Contractor responsible for fitting parts together: Contractor shall do all cutting, fitting, or patching that may be required to make its several parts fit together properly, or receive or be received by work of others set forth in, or reasonably implied by, the Contract Documents. Contractor shall not endanger any work by cutting, excavating, or otherwise altering the Work and shall not cut or alter the work of any other contractor unless approved in advance by Owner.

C. Owner may reject defective Work: Should any of the Work be found defective, or in any way not in accordance with the Contract Documents, this work, in whatever stage of completion, may be rejected by Owner.

5.14 AVAILABILITY AND USE OF UTILITY SERVICES

A. Owner to provide and charge for utilities: Owner shall make all reasonable utilities available to Contractor from existing outlets and supplies, as specified in the Contract Documents. Unless otherwise provided in the Contract Documents, the utility service consumed shall be charged to or paid for by Contractor at prevailing rates charged to Owner or, where the utility is produced by Owner, at reasonable rates determined by Owner. Contractor will carefully conserve any utilities furnished.

B. Contractor to install temporary connections and meters: Contractor shall, at its expense and in a skillful manner satisfactory to Owner, install and maintain all necessary temporary connections and distribution lines, together with appropriate protective devices, and all meters required to measure the amount of each utility used for the purpose of determining charges. Prior to the date of Final Acceptance, Contractor shall remove all temporary connections, distribution lines, meters, and associated equipment and materials.

5.15 TESTS AND INSPECTION

A. Contractor to provide for all testing and inspection of Work: Contractor shall maintain an adequate testing and inspection program and perform such tests and inspections as are necessary or required to ensure that the Work conforms to the requirements of the Contract Documents. Contractor shall be responsible for inspection and quality surveillance of all its Work and all Work performed by any Subcontractor. Unless otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. Contractor shall give Owner timely notice of when and

where tests and inspections are to be made. Contractor shall maintain complete inspection records and make them available to Owner.

B. Owner may conduct tests and inspections: Owner may, at any reasonable time, conduct such inspections and tests as it deems necessary to ensure that the Work is in accordance with the Contract Documents. Owner shall promptly notify Contractor if an inspection or test reveals that the Work is not in accordance with the Contract Documents. Unless the subject items are expressly accepted by Owner, such Owner inspection and tests are for the sole benefit of Owner and do not:

1. Constitute or imply acceptance;

2. Relieve Contractor of responsibility for providing adequate quality control measures;

3. Relieve Contractor of responsibility for risk of loss or damage to the Work, materials, or equipment;

4. Relieve Contractor of its responsibility to comply with the requirements of the Contract Documents; or

5. Impair Owner's right to reject defective or nonconforming items, or to avail itself of any other remedy to which it may be entitled.

C. Inspections or inspectors do not modify Contract Documents: Neither observations by an inspector retained by Owner, the presence or absence of such inspector on the site, nor inspections, tests, or approvals by others, shall relieve Contractor from any requirement of the Contract Documents, nor is any such inspector authorized to change any term or condition of the Contract Documents.

D. Contractor responsibilities on inspections: Contractor shall promptly furnish, without additional charge, all facilities, labor, material and equipment reasonably needed for performing such safe and convenient inspections and tests as may be required by Owner. Owner may charge Contractor any additional cost of inspection or testing when Work is not ready at the time specified by Contractor for inspection or testing, or when prior rejection makes reinspection or retest necessary. Owner shall perform its inspections and tests in a manner that will cause no undue delay in the Work.

5.16 CORRECTION OF NONCONFORMING WORK

A. Work covered by Contractor without inspection: If a portion of the Work is covered contrary to the requirements in the Contract Documents, it must, if required in writing by Owner, be uncovered for Owner's observation and be replaced at the Contractor's expense and without change in the Contract Time.

B. Payment provisions for uncovering covered Work: If, at any time prior to Final Completion, Owner desires to examine the Work, or any portion of it, which has been covered, Owner may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an adjustment in the Contract Sum for the costs of uncovering and replacement, and, if completion of the Work is thereby delayed, an adjustment in the Contract Time, provided it makes such a request as provided in Part 7. If such Work is not in accordance with the Contract Documents, the Contractor shall pay the costs of examination and reconstruction.

C. Contractor to correct and pay for non-conforming Work: Contractor shall promptly correct Work found by Owner not to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or

completed. Contractor shall bear all costs of correcting such nonconforming Work, including additional testing and inspections.

D. Contractor's compliance with warranty provisions: If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or within one year after the date for commencement of any system warranties established under Section 6.08, or within the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, Contractor shall correct it promptly after receipt of written notice from Owner to do so. Owner shall give such notice promptly after discovery of the condition. This period of one year shall be extended, with respect to portions of Work first performed after Substantial Completion, by the period of time between Substantial Completion and the actual performance of the Work. Contractor's duty to correct with respect to Work repaired or replaced shall run for one year from the date of repair or replacement. Obligations under this paragraph shall survive Final Acceptance.

E. Contractor to remove non-conforming Work: Contractor shall remove from the Project site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Owner.

F. Owner may charge Contractor for non-conforming Work: If Contractor fails to correct nonconforming Work within a reasonable time after written notice to do so, Owner may replace, correct, or remove the nonconforming Work and charge the cost thereof to the Contractor.

G. Contractor to pay for damaged Work during correction: Contractor shall bear the cost of correcting destroyed or damaged Work, whether completed or partially completed, caused by Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

H. No Period of limitation on other requirements: Nothing contained in this section shall be construed to establish a period of limitation with respect to other obligations which Contractor might have according to the Contract Documents. Establishment of the time period of one year as described in Section 5.16D relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be sought to be enforced, including the time within which such proceedings may be commenced.

I. Owner may accept non-conforming Work and charge Contractor: If Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Owner may do so instead of requiring its removal and correction, in which case the Contract Sum may be reduced as appropriate and equitable.

5.17 CLEAN UP

Contractor to keep site clean and leave it clean: Contractor shall at all times keep the Project site, including hauling routes, infrastructures, utilities, and storage areas, free from accumulations of waste materials. Before completing the Work, Contractor shall remove from the premises its rubbish, tools, scaffolding, equipment, and materials. Upon completing the Work, Contractor shall leave the Project site in a clean, neat, and orderly condition satisfactory to Owner. If Contractor fails to clean up as provided herein, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be charged to Contractor.

5.18 ACCESS TO WORK

Owner and A/E access to Work site: Contractor shall provide Owner and A/E access to the Work in progress wherever located.

5.19 OTHER CONTRACTS

Owner may award other contracts; Contractor to cooperate: Owner may undertake or award other contracts for additional work at or near the Project site. Contractor shall reasonably cooperate with the other contractors and with Owner's employees and shall carefully adapt scheduling and perform the Work in accordance with these Contract Documents to reasonably accommodate the other work.

5.20 SUBCONTRACTORS AND SUPPLIERS

A. Subcontractor Responsibility: The Contractor shall include the language of this paragraph in each of its first tier subcontracts, and shall require each of its subcontractors to include the same language of this section in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Owner, the Contractor shall promptly provide documentation to the Owner demonstrating that the subcontractor meets the subcontractor responsibility criteria below. The requirements of this paragraph apply to all subcontractors regardless of tier. At the time of subcontract execution, the Contractor shall verify that each of its first tier subcontractors meets the following bidder responsibility criteria:

1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;

2. Have a current Washington Unified Business Identifier (UBI) number;

3. If applicable, have:

    a. Industrial Insurance (workers' compensation) coverage for the subcontractor's employees working in Washington, as required in Title 51 RCW;

    b. A Washington Employment Security Department number, as required in Title 50 RCW;

    c. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;

    d. An electrical contractor license, if required by Chapter 19.28 RCW;

    e. An elevator contractor license, if required by Chapter 70.87 RCW.

4. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065 (3).

5. On a project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the date of the Owner's first advertisement of the project.

B. Provide names of Subcontractors and use qualified firms: Before submitting the first Application for Payment, Contractor shall furnish in writing to Owner the names, addresses, and telephone numbers of all Subcontractors, as well as suppliers providing materials in excess of $2,500. Contractor shall utilize Subcontractors and suppliers which are experienced and qualified, and meet the requirements of the Contract Documents, if any. Contractor shall not utilize any Subcontractor or supplier to whom the Owner has a reasonable objection, and shall obtain Owner's written consent before making any substitutions or additions.

C. Subcontracts in writing and pass through provision: All Subcontracts must be in writing. By appropriate written agreement, Contractor shall require each Subcontractor, so far as applicable to the Work to be performed by the Subcontractor, to be bound to Contractor by terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities which Contractor assumes toward Owner in accordance with the Contract Documents. Each Subcontract shall preserve and protect the rights of Owner in accordance with the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. However, nothing in this paragraph shall be construed to alter the contractual relations between Contractor and its Subcontractors with respect to insurance or bonds.

D. Coordination of Subcontractors; Contractor responsible for Work: Contractor shall schedule, supervise, and coordinate the operations of all Subcontractors. No Subcontracting of any of the Work shall relieve Contractor from its responsibility for the performance of the Work in accordance with the Contract Documents or any other obligations of the Contract Documents.

E. Automatic assignment of subcontracts: Each subcontract agreement for a portion of the Work is hereby assigned by Contractor to Owner provided that:

1. Effective only after termination and Owner approval: The assignment is effective only after termination by Owner for cause pursuant to Section 9.01 and only for those Subcontracts which Owner accepts by notifying the Subcontractor in writing; and

2. Owner assumes Contractor's responsibilities: After the assignment is effective, Owner will assume all future duties and obligations toward the Subcontractor which Contractor assumed in the Subcontract.

3. Impact of bond: The assignment is subject to the prior rights of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

5.21 WARRANTY OF CONSTRUCTION

A. Contractor warranty of Work: In addition to any special warranties provided elsewhere in the Contract Documents, Contractor warrants that all Work conforms to the requirements of the Contract Documents and is free of any defect in equipment, material, or design furnished, or workmanship performed by Contractor.

B. Contractor responsibilities: With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract Documents, Contractor shall:

1. Obtain warranties: Obtain all warranties that would be given in normal commercial practice;

2. Warranties for benefit of Owner: Require all warranties to be executed, in writing, for the benefit of Owner;

3. Enforcement of warranties: Enforce all warranties for the benefit of Owner, if directed by Owner; and

4. Contractor responsibility for subcontractor warranties: Be responsible to enforce any subcontractor's, manufacturer's, or supplier's warranties should they extend beyond the period specified in the Contract Documents.

C. Warranties beyond Final Acceptance: The obligations under this section shall survive Final Acceptance.

5.22 INDEMNIFICATION

A. Contractor to indemnify Owner: Contractor shall defend, indemnify, and hold Owner and A/E harmless from and against all claims, demands, losses, damages, or costs, including but not limited to damages arising out of bodily injury or death to persons and damage to property, caused by or resulting from:

1. Sole negligence of Contractor: The sole negligence of Contractor or any of its Subcontractors;

2. Concurrent negligence: The concurrent negligence of Contractor, or any Subcontractor, but only to the extent of the negligence of Contractor or such Subcontractor; and

3. Patent infringement: The use of any design, process, or equipment which constitutes an infringement of any United States patent presently issued, or violates any other proprietary interest, including copyright, trademark, and trade secret.

B. Employee action and RCW Title 51: In any action against Owner and any other entity indemnified in accordance with this section, by any employee of Contractor, its Subcontractors, Sub-subcontractors, agents, or anyone directly or indirectly employed by any of them, the indemnification obligation of this section shall not be limited by a limit on the amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under RCW Title 51, the Industrial Insurance Act, or any other employee benefit acts. In addition, Contractor waives immunity as to Owner and A/E only, in accordance with RCW Title 51.

PART 6 – PAYMENTS AND COMPLETION

6.01 CONTRACT SUM

Owner shall pay Contract Sum: Owner shall pay Contractor the Contract Sum plus state sales tax for performance of the Work, in accordance with the Contract Documents.

6.02 SCHEDULE OF VALUES

Contractor to submit Schedule of Values: Before submitting its first Application for Payment, Contractor shall submit to Owner for approval a breakdown allocating the total Contract Sum to each principal category of work, in such detail as requested by Owner ("Schedule of Values"). The approved Schedule of Values shall include appropriate amounts for demobilization, record drawings, O&M manuals, and any other requirements for Project closeout, and shall be used by Owner as the basis for progress payments. Payment for Work shall be made only for and in accordance with those items included in the Schedule of Values.

6.03 APPLICATION FOR PAYMENT

A. Monthly Application for Payment with substantiation: At monthly intervals, unless determined otherwise by Owner, Contractor shall submit to Owner an itemized Application for Payment for Work completed in accordance with the Contract Documents and the approved Schedule of Values. Each application shall be supported by such substantiating data as Owner may require.

B. Contractor certifies Subcontractors paid: By submitting an Application for Payment, Contractor is certifying that all Subcontractors have been paid, less earned retainage in accordance with RCW 60.28.011, as their interests appeared in the last preceding certificate of payment. By submitting an Application for Payment, Contractor is recertifying that the representations set forth in Section 1.03, are true and correct, to the best of Contractor's knowledge, as of the date of the Application for Payment.

C. Reconciliation of Work with Progress Schedule: At the time it submits an Application for Payment, Contractor shall analyze and reconcile, to the satisfaction of Owner, the actual progress of the Work with the Progress Schedule.

D. Payment for material delivered to site or stored off-site: If authorized by Owner, the Application for Payment may include request for payment for material delivered to the Project site and suitably stored, or for completed preparatory work. Payment may similarly be requested for material stored off the Project site, provided Contractor complies with or furnishes satisfactory evidence of the following:

1. Suitable facility or location: The material will be placed in a facility or location that is structurally sound, dry, lighted and suitable for the materials to be stored;

2. Facility or location within 10 miles of Project: The facility or location is located within a 10-mile radius of the Project. Other locations may be utilized, if approved in writing, by Owner;

3. Facility or location exclusive to Project's materials: Only materials for the Project are stored within the facility or location (or a secure portion of a facility or location set aside for the Project);

4. Insurance provided on materials in facility or location: Contractor furnishes Owner a certificate of insurance extending Contractor's insurance coverage for damage, fire, and theft to cover the full value of all materials stored, or in transit;

5. Facility or location locked and secure: The facility or location (or secure portion thereof) is continuously under lock and key, and only Contractor's authorized personnel shall have access;

6. Owner right of access to facility or location: Owner shall at all times have the right of access in company of Contractor;

7. Contractor assumes total responsibility for stored materials: Contractor and its surety assume total responsibility for the stored materials; and

8. Contractor provides documentation and Notice when materials moved to site: Contractor furnishes to Owner certified lists of materials stored, bills of lading, invoices, and other information as may be required, and shall also furnish Notice to Owner when materials are moved from storage to the Project site.

6.04 PROGRESS PAYMENTS

A. Owner to pay within 30 Days: Owner shall make progress payments, in such amounts as Owner determines are properly due, within 30 Days after receipt of a properly executed Application for Payment. Owner shall notify Contractor in accordance with chapter 39.76 RCW if the Application for Payment does not comply with the requirements of the Contract Documents.

B. Withholding retainage; Options for retainage: Owner shall retain 5% of the amount of each progress payment until 45 Days after Final Acceptance and receipt of all documents required by law or the Contract Documents, including, at Owner's request, consent of surety to release of the retainage. In accordance with chapter 60.28 RCW, Contractor may request that monies reserved be retained in a fund by Owner, deposited by Owner in a bank or savings and loan, or placed in escrow with a bank or trust company to be converted into bonds and securities to be held in escrow with interest to be paid to Contractor. Owner may permit Contractor to provide an appropriate bond in lieu of the retained funds.

C. Title passes to Owner upon payment: Title to all Work and materials covered by a progress payment shall pass to Owner at the time of such payment free and clear of all liens, claims, security interests, and encumbrances. Passage of title shall not, however, relieve Contractor from any of its duties and responsibilities for the Work or materials, or waive any rights of Owner to insist on full compliance by Contractor with the Contract Documents.

D. Interest on unpaid balances: Payments due and unpaid in accordance with the Contract Documents shall bear interest as specified in chapter 39.76 RCW.

6.05 PAYMENTS WITHHELD

A. Owner's right to withhold payment: Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any payment to such extent as may be necessary to protect Owner from loss or damage for reasons including but not limited to:

1. Non-compliant Work: Work not in accordance with the Contract Documents;

2. Remaining Work to cost more than unpaid balance: Reasonable evidence that the Work required by the Contract Documents cannot be completed for the unpaid balance of the Contract Sum;

3. Owner correction or completion Work: Work by Owner to correct defective Work or complete the Work in accordance with Section 5.16;

4. Contractor's failure to perform: Contractor's failure to perform in accordance with the Contract Documents; or

5. Contractor's negligent acts or omissions: Cost or liability that may occur to Owner as the result of Contractor's fault or negligent acts or omissions.

B. Owner to notify Contractor of withholding for unsatisfactory performance: In any case where part or all of a payment is going to be withheld for unsatisfactory performance, Owner shall notify Contractor in accordance with chapter 39.76 RCW.

6.06 RETAINAGE AND BOND CLAIM RIGHTS

Chapters 39.08 RCW and 60.28 RCW incorporated by reference: Chapters 39.08 RCW and 60.28 RCW, concerning the rights and responsibilities of Contractor and Owner with regard to the performance and payment bonds and retainage, are made a part of the Contract Documents by reference as though fully set forth herein.

6.07 SUBSTANTIAL COMPLETION

Substantial Completion defined: Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so Owner has full and unrestricted use and benefit of the facilities (or portion thereof designated and approved by Owner) for the use for which it is intended. All Work other than incidental corrective or punch list work shall be completed. Substantial Completion shall not have been achieved if all systems and parts are not functional, if utilities are not connected and operating normally, if all required occupancy permits have not been issued, or if the Work is not accessible by normal vehicular and pedestrian traffic routes. The date Substantial Completion is achieved shall be established in writing by Owner. Contractor may request an early date of Substantial Completion which must be approved by Change Order. Owner's occupancy of the Work or designated portion thereof does not necessarily indicate that Substantial Completion has been achieved.

6.08 PRIOR OCCUPANCY

A. Prior Occupancy defined; Restrictions: Owner may, upon written notice thereof to Contractor, take possession of or use any completed or partially completed portion of the Work ("Prior Occupancy") at any time prior to Substantial Completion. Unless otherwise agreed in writing, Prior Occupancy shall not: be deemed an acceptance of any portion of the Work; accelerate the time for any payment to Contractor; prejudice any rights of Owner provided by any insurance, bond, guaranty, or the Contract Documents; relieve Contractor of the risk of loss or any of the obligations established by the Contract Documents; establish a date for termination or partial termination of the assessment of liquidated damages; or constitute a waiver of claims.

B. Damage; Duty to repair and warranties: Notwithstanding anything in the preceding paragraph, Owner shall be responsible for loss of or damage to the Work resulting from Prior Occupancy. Contractor's one year duty to repair any system warranties shall begin on building systems activated and used by Owner as agreed in writing by Owner and Contractor.

6.09 FINAL COMPLETION, ACCEPTANCE, AND PAYMENT

A. Final Completion defined: Final Completion shall be achieved when the Work is fully and finally complete in accordance with the Contract Documents. The date Final Completion is achieved shall be established by Owner in writing, but in no case shall constitute Final Acceptance which is a subsequent, separate, and distinct action.

B. Final Acceptance defined: Final Acceptance shall be achieved when the Contractor has completed the requirements of the Contract Documents. The date Final Acceptance is achieved shall be established by Owner in writing. Prior to Final Acceptance, Contractor shall, in addition to all other requirements in the Contract Documents, submit to Owner a written notice of any outstanding disputes or claims between Contractor and any of its Subcontractors, including the amounts and other details thereof. Neither Final Acceptance, nor final payment, shall release Contractor or its sureties from any obligations of these Contract Documents or the payment and performance bonds, or constitute a waiver of any claims by Owner arising from Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Final payment waives Claim rights: Acceptance of final payment by Contractor, or any Subcontractor, shall constitute a waiver and release to Owner of all claims by Contractor, or any such Subcontractor, for an increase in the Contract Sum or the Contract Time, and for every act or omission of Owner relating to or arising out of the Work, except for those Claims made in accordance with the procedures, including the time limits, set forth in Part 8.

PART 7 – CHANGES

7.01 CHANGE IN THE WORK

A. Changes in Work, Contract Sum, and Contract Time by Change Order: Owner may, at any time and without notice to Contractor's surety, order additions, deletions, revisions, or other changes in the Work. These changes in the Work shall be incorporated into the Contract Documents through the execution of Change Orders. If any change in the Work ordered by Owner causes an increase or decrease in the Contract Sum or the Contract Time, an equitable adjustment shall be made as provided in Section 7.02 or 7.03, respectively, and such adjustment(s) shall be incorporated into a Change Order.

B. Owner may request COP from Contractor: If Owner desires to order a change in the Work, it may request a written Change Order Proposal (COP) from Contractor. Contractor shall submit a Change Order Proposal within 14 Days of the request from Owner, or within such other period as mutually agreed. Contractor's Change Order Proposal shall be full compensation for

implementing the proposed change in the Work, including any adjustment in the Contract Sum or Contract Time, and including compensation for all delays in connection with such change in the Work and for any expense or inconvenience, disruption of schedule, or loss of efficiency or productivity occasioned by the change in the Work.

C. COP negotiations: Upon receipt of the Change Order Proposal, or a request for equitable adjustment in the Contract Sum or Contract Time, or both, as provided in Sections 7.02 and 7.03, Owner may accept or reject the proposal, request further documentation, or negotiate acceptable terms with Contractor. Pending agreement on the terms of the Change Order, Owner may direct Contractor to proceed immediately with the Change Order Work. Contractor shall not proceed with any change in the Work until it has obtained Owner's approval. All Work done pursuant to any Owner-directed change in the Work shall be executed in accordance with the Contract Documents.

D. Change Order as full payment and final settlement: If Owner and Contractor reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, such agreement shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of all claims for time and for direct, indirect, and consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity, related to any Work either covered or affected by the Change Order, or related to the events giving rise to the request for equitable adjustment.

E. Failure to agree upon terms of Change Order; Final offer and Claims: If Owner and Contractor are unable to reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, Contractor may at any time in writing, request a final offer from Owner. Owner shall provide Contractor with its written response within 30 Days of Contractor's request. Owner may also provide Contractor with a final offer at any time. If Contractor rejects Owner's final offer, or the parties are otherwise unable to reach agreement, Contractor's only remedy shall be to file a Claim as provided in Part 8.

F. Field Authorizations: The Owner may direct the Contractor to proceed with a change in the work through a written Field Authorization (also referred to as a Field Order) when the time required to price and execute a Change Order would impact the Project.

The Field Authorization shall describe and include the following:

1. The scope of work
2. An agreed upon maximum not-to-exceed amount
3. Any estimated change to the Contract Time
4. The method of final cost determination in accordance with the requirements of Part 7 of the General Conditions
5. The supporting cost data to be submitted in accordance with the requirements of Part 7 of the General Conditions

Upon satisfactory submittal by the Contractor and approval by the Owner of supporting cost data, a Change Order will be executed. The Owner will not make payment to the Contractor for Field Authorization work until that work has been incorporated into an executed Change Order.

7.02 CHANGE IN THE CONTRACT SUM

A. General Application

1. Contract Sum changes only by Change Order: The Contract Sum shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Sum in its Change Order Proposal.

2. Owner fault or negligence as basis for change in Contract Sum: If the cost of Contractor's performance is changed due to the fault or negligence of Owner, or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Sum in accordance with the following procedure. No change in the Contract Sum shall be allowed to the extent: Contractor's changed cost of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible; the change is concurrently caused by Contractor and Owner; or the change is caused by an act of Force Majeure as defined in Section 3.05.

   (a) Notice and record keeping for equitable adjustment: A request for an equitable adjustment in the Contract Sum shall be based on written notice delivered to Owner within 7 Days of the occurrence of the event giving rise to the request. For purposes of this part, "occurrence" means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request. If Contractor believes it is entitled to an adjustment in the Contract Sum, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such records and, if requested shall promptly furnish copies of such records to Owner.

   (b) Content of notice for equitable adjustment; Failure to comply: Contractor shall not be entitled to any adjustment in the Contract Sum for any occurrence of events or costs that occurred more than 7 Days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Sum; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Sum requested. Failure to properly give such written notice shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

   (c) Contractor to provide supplemental information: Within 30 Days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph a. above with additional supporting data. Such additional data shall include, at a minimum: the amount of compensation requested, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the damages claimed, but that the damages claimed were actually a result of the act, event, or condition complained of and that the Contract Documents provide entitlement to an equitable adjustment to Contractor for such act, event, or condition; and documentation sufficiently detailed to permit an informed analysis of the request by Owner. When the request for compensation relates to a delay, or other change in Contract Time, Contractor shall demonstrate the impact on the critical path, in accordance with Section 7.03C. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

(d) Contractor to proceed with Work as directed: Pending final resolution of any request made in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

(e) Contractor to combine requests for same event together: Any requests by Contractor for an equitable adjustment in the Contract Sum and in the Contract Time that arise out of the same event(s) shall be submitted together.

3. Methods for calculating Change Order amount: The value of any Work covered by a Change Order, or of any request for an equitable adjustment in the Contract Sum, shall be determined by one of the following methods:

   a. Fixed Price: On the basis of a fixed price as determined in paragraph 7.02B.

   b. Unit Prices: By application of unit prices to the quantities of the items involved as determined in paragraph 7.02C.

   c. Time and Materials: On the basis of time and material as determined in paragraph 7.02D.

4. Fixed price method is default; Owner may direct otherwise: When Owner has requested Contractor to submit a Change Order Proposal, Owner may direct Contractor as to which method in subparagraph 3 above to use when submitting its proposal. Otherwise, Contractor shall determine the value of the Work, or of a request for an equitable adjustment, on the basis of the fixed price method.

B. Change Order Pricing – Fixed Price

Procedures: When the fixed price method is used to determine the value of any Work covered by a Change Order, or of a request for an equitable adjustment in the Contract Sum, the following procedures shall apply:

1. Breakdown and itemization of details on COP: Contractor's Change Order Proposal, or request for adjustment in the Contract Sum, shall be accompanied by a complete itemization of the costs, including labor, material, subcontractor costs, and overhead and profit. The costs shall be itemized in the manner set forth below, and shall be submitted on breakdown sheets in a form approved by Owner.

2. Use of industry standards in calculating costs: All costs shall be calculated based upon appropriate industry standard methods of calculating labor, material quantities, and equipment costs.

3. Costs contingent on Owner's actions: If any of Contractor's pricing assumptions are contingent upon anticipated actions of Owner, Contractor shall clearly state them in the proposal or request for an equitable adjustment.

4. Markups on additive and deductive Work: The cost of any additive or deductive changes in the Work shall be calculated as set forth below, except that overhead and profit shall not be included on deductive changes in the Work. Where a change in the Work involves additive and deductive work by the same Contractor or Subcontractor, small tools, overhead, profit, bond and insurance markups will apply to the net difference.

5. Breakdown not required if change less than $1,000: If the total cost of the change in the Work or request for equitable adjustment does not exceed $1,000, Contractor shall not be required to submit a breakdown if the description of the change in the Work or request for equitable adjustment is sufficiently definitive for Owner to determine fair value.

6. Breakdown required if change between $1,000 and $2,500: If the total cost of the change in the Work or request for equitable adjustment is between $1,000 and $2,500, Contractor may submit a breakdown in the following level of detail if the description of the change in the Work or if the request for equitable adjustment is sufficiently definitive to permit the Owner to determine fair value:

   a. lump sum labor;

   b. lump sum material;

   c. lump sum equipment usage;

   d. overhead and profit as set forth below; and

   e. insurance and bond costs as set forth below.

7. Components of increased cost: Any request for adjustment of Contract Sum based upon the fixed price method shall include only the following items:

   a. Craft labor costs: These are the labor costs determined by multiplying the estimated or actual additional number of craft hours needed to perform the change in the Work by the hourly labor costs. Craft hours should cover direct labor, as well as indirect labor due to trade inefficiencies. The hourly costs shall be based on the following:

      (1) Basic wages and benefits: Hourly rates and benefits as stated on the Department of Labor and Industries approved "statement of intent to pay prevailing wages" or a higher amount if approved by the Owner. Direct supervision shall be a reasonable percentage not to exceed 15% of the cost of direct labor. No supervision markup shall be allowed for a working supervisor's hours.

      (2) Worker's insurance: Direct contributions to the state of Washington for industrial insurance; medical aid; and supplemental pension, by the class and rates established by the Department of Labor and Industries.

      (3) Federal insurance: Direct contributions required by the Federal Insurance Compensation Act; Federal Unemployment Tax Act; and the State Unemployment Compensation Act.

      (4) Travel allowance: Travel allowance and/or subsistence, if applicable, not exceeding those allowances established by regional labor union agreements, which are itemized and identified separately.

      (5) Safety: Cost incurred due to the Washington Industrial Safety and Health Act, which shall be a reasonable percentage not to exceed 2% of the sum of the amounts calculated in (1), (2), and (3) above.

   b. Material costs: This is an itemization of the quantity and cost of materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs, second from supplier quotations or if these are not available, from standard industry pricing guides. Material costs shall consider all available discounts. Freight costs, express charges, or special delivery charges, shall be itemized.

c. Equipment costs: This is an itemization of the type of equipment and the estimated or actual length of time the construction equipment appropriate for the Work is or will be used on the change in the Work. Costs will be allowed for construction equipment only if used solely for the changed Work, or for additional rental costs actually incurred by the Contractor. Equipment charges shall be computed on the basis of actual invoice costs or if owned, from the current edition of one of the following sources:

(1) Associated General Contractors Washington State Department of Transportation (AGC WSDOT) Equipment Rental Agreement current edition, on the Contract execution date.

(2) The National Electrical Contractors Association for equipment used on electrical work.

(3) The Mechanical Contractors Association of America for equipment used on mechanical work.

The EquipmentWatch Rental Rate Blue Book shall be used as a basis for establishing rental rates of equipment not listed in the above sources. The maximum rate for standby equipment shall not exceed that shown in the AGC WSDOT Equipment Rental Agreement, current edition on the Contract execution date.

d. Allowance for small tools, expendables & consumable supplies: Small tools consist of tools which cost $250 or less and are normally furnished by the performing contractor. The maximum rate for small tools shall not exceed the following:

(1) 3% for Contractor: For Contractor, 3% of direct labor costs.

(2) 5% for Subcontractors: For Subcontractors, 5% of direct labor costs.

Expendables and consumables supplies directly associated with the change in Work must be itemized.

e. Subcontractor costs: This is defined as payments Contractor makes to Subcontractors for changed Work performed by Subcontractors of any tier. The Subcontractors' cost of Work shall be calculated and itemized in the same manner as prescribed herein for Contractor.

f. Allowance for overhead: This is defined as costs of any kind attributable to direct and indirect delay, acceleration, or impact, added to the total cost to Owner of any change in the Contract Sum. If the Contractor is compensated under Section 7.03D, the amount of such compensation shall be reduced by the amount Contractor is otherwise entitled to under this subsection (f). This allowance shall compensate Contractor for all noncraft labor, temporary construction facilities, field engineering, schedule updating, as-built drawings, home office cost, B&O taxes, office engineering, estimating costs, additional overhead because of extended time, and any other cost incidental to the change in the Work. It shall be strictly limited in all cases to a reasonable amount, mutually acceptable, or if none can be agreed upon to an amount not to exceed the rates below:

(1). Projects less than $3 million: For projects where the Contract Award Amount is under $3 million, the following shall apply:

(a) Contractor markup on Contractor Work: For Contractor, for any Work actually performed by Contractor's own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(b) Subcontractor markup for Subcontractor Work: For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(c) Contractor markup for Subcontractor Work: For Contractor, for any work performed by its Subcontractor(s) 6% of the first $50,000 of the amount due each Subcontractor, and 4% of the remaining amount if any.

(d) Subcontractor markup for lower tier Subcontractor Work: For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

(e) Basis of cost applicable for markup: The cost to which overhead is to be applied shall be developed in accordance with Section 7.02B 7a. – e.

(2). Projects more than $3 million: For projects where the Contract Award Amount is equal to or exceeds $3 million, the following shall apply:

(a) Contractor markup on Contractor Work: For Contractor, for any Work actually performed by Contractor's own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(b) Subcontractor markup for Subcontractor Work: For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

(c) Contractor markup for Subcontractor Work: For Contractor, for any Work performed by its Subcontractor(s), 4% of the first $50,000 of the amount due each Subcontractor, and 2% of the remaining amount if any.

(d) Subcontractor markup for lower tier Subcontractor Work: For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

(e) Basis of cost applicable for markup: The cost to which overhead is to be applied shall be developed in accordance with Section 7.02B 7a. – e.

g. Allowance for profit: Allowance for profit is an amount to be added to the cost of any change in contract sum, but not to the cost of change in Contract Time for which contractor has been compensated pursuant to the conditions set forth in Section 7.03. It shall be limited to a reasonable amount, mutually acceptable, or if none can be agreed upon, to an amount not to exceed the rates below:

(1) Contractor / Subcontractor markup for self-performed Work: For Contractor or Subcontractor of any tier for work performed by their forces, 6% of the cost developed in accordance with Section 7.02B 7a. – e.

(2) Contractor / Subcontractor markup for Work performed at lower tier: For Contractor or Subcontractor of any tier for work performed by a subcontractor of a lower tier, 4% of the subcontract cost developed in accordance with Section 7.02B 7a. – h.

h. Insurance and bond premiums: Cost of change in insurance or bond premium: This is defined as:

(1) Contractor's liability insurance: The cost of any changes in Contractor's liability insurance arising directly from execution of the Change Order; and

(2) Payment and Performance Bond: The cost of the additional premium for Contractor's bond arising directly from the changed Work.

The cost of any change in insurance or bond premium shall be added after overhead and allowance for profit are calculated in accordance with subparagraph f. and g above.

C. Change Order Pricing – Unit Prices

1. Content of Owner authorization: Whenever Owner authorizes Contractor to perform Work on a unit-price basis, Owner's authorization shall clearly state:

a. Scope: Scope of work to be performed;

b. Reimbursement basis: Type of reimbursement including pre-agreed rates for material quantities; and

c. Reimbursement limit: Cost limit of reimbursement.

2. Contractor responsibilities: Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, Contractor shall identify workers assigned to the Change Order Work and areas in which they are working;

b. Leave access as appropriate for quantity measurement; and

c. Not exceed any cost limit(s) without Owner's prior written approval.

3. Cost breakdown consistent with Fixed Price requirements: Contractor shall submit costs in accordance with paragraph 7.02B and satisfy the following requirements:

a. Unit prices must include overhead, profit, bond and insurance premiums: Unit prices shall include reimbursement for all direct and indirect costs of the Work, including overhead, profit, bond, and insurance costs; and

b. Owner verification of quantities: Quantities must be supported by field measurement statements signed by Owner.

D. Change Order Pricing – Time-and-Material Prices

1. Content of Owner authorization: Whenever Owner authorizes Contractor to perform Work on a time-and-material basis, Owner's authorization shall clearly state:

a. Scope: Scope of Work to be performed;

b. Reimbursement basis: Type of reimbursement including pre-agreed rates, if any, for material quantities or labor; and

c. Reimbursement limit: Cost limit of reimbursement.

2. Contractor responsibilities: Contractor shall:

a. Identify workers assigned: Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, identify workers assigned to the Change Order Work and areas in which they are working;

b. Provide daily timesheets: Identify on daily time sheets all labor performed in accordance with this authorization. Submit copies of daily time sheets within 2 working days for Owner's review.

c. Allow Owner to measure quantities: Leave access as appropriate for quantity measurement;

d. Perform Work efficiently: Perform all Work in accordance with this section as efficiently as possible; and

e. Not exceed Owner's cost limit: Not exceed any cost limit(s) without Owner's prior written approval.

3. Cost breakdown consistent with Fixed Price requirements: Contractor shall submit costs in accordance with paragraph 7.02B and additional verification supported by:

a. Timesheets: Labor detailed on daily time sheets; and

b. Invoices: Invoices for material.

7.03 CHANGE IN THE CONTRACT TIME

A. COP requests for Contract Time: The Contract Time shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Time in its Change Order Proposal.

B. Time extension permitted if not Contractor's fault: If the time of Contractor's performance is changed due to an act of Force Majeure, or due to the fault or negligence of Owner or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Time in accordance with the following procedure. No adjustment in the Contract Time shall be allowed to the extent Contractor's changed time of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible.

1. Notice and record keeping for Contract Time request: A request for an equitable adjustment in the Contract Time shall be based on written notice delivered within 7 Days of the occurrence of the event giving rise to the request. If Contractor believes it is entitled to adjustment of Contract Time, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such record and if requested, shall promptly furnish copies of such record to Owner.

2. Timing and content of Contractor's Notice: Contractor shall not be entitled to an adjustment in the Contract Time for any events that occurred more than 7 Days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the

Contract Time; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Time requested. Failure to properly give such written notice shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

3. Contractor to provide supplemental information: Within 30 Days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph 7.03B.2 with additional supporting data. Such additional data shall include, at a minimum: the amount of delay claimed, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the delay claimed, but that the delay claimed was actually a result of the act, event, or condition complained of, and that the Contract Documents provide entitlement to an equitable adjustment in Contract Time for such act, event, or condition; and supporting documentation sufficiently detailed to permit an informed analysis of the request by Owner. Failure to provide such additional information and documentation within the time allowed or within the format required shall, to the extent Owner's interests are prejudiced, constitute a waiver of Contractor's right to an equitable adjustment.

4. Contractor to proceed with Work as directed: Pending final resolution of any request in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

C. Contractor to demonstrate impact on critical path of schedule: Any change in the Contract Time covered by a Change Order, or based on a request for an equitable adjustment in the Contract Time, shall be limited to the change in the critical path of Contractor's schedule attributable to the change of Work or event(s) giving rise to the request for equitable adjustment. Any Change Order Proposal or request for an adjustment in the Contract Time shall demonstrate the impact on the critical path of the schedule. Contractor shall be responsible for showing clearly on the Progress Schedule that the change or event: had a specific impact on the critical path, and except in case of concurrent delay, was the sole cause of such impact; and could not have been avoided by resequencing of the Work or other reasonable alternatives.

D. Cost of change in Contract Time: Contractor may request compensation for the cost of a change in Contract Time in accordance with this paragraph, 7.03D, subject to the following conditions:

1. Must be solely fault of Owner or A/E: The change in Contract Time shall solely be caused by the fault or negligence of Owner or A/E;

2. Procedures: Contractor shall follow the procedure set forth in paragraph 7.03B;

3. Demonstrate impact on critical path: Contractor shall establish the extent of the change in Contract Time in accordance with paragraph 7.03C; and

4. Limitations on daily costs: The daily cost of any change in Contract Time shall be limited to the items below, less the amount of any change in the Contract Sum the Contractor may otherwise be entitled to pursuant to Section 7.02B 7f for any change in the Work that contributed to this change in Contract Time:

   a. Non-productive supervision or labor: cost of nonproductive field supervision or labor extended because of delay;

   b. Weekly meetings and indirect activities: cost of weekly meetings or similar indirect activities extended because of the delay;

c. Temporary facilities or equipment rental: cost of temporary facilities or equipment rental extended because of the delay;

d. Insurance premiums: cost of insurance extended because of the delay;

e. Overhead: general and administrative overhead in an amount to be agreed upon, but not to exceed 3% of the Contract Award Amount divided by the originally specified Contract Time for each Day of the delay.

PART 8 – CLAIMS AND DISPUTE RESOLUTION

8.01 CLAIMS PROCEDURE

A. Claim is Contractor's remedy: If the parties fail to reach agreement on the terms of any Change Order for Owner-directed Work as provided in Section 7.01, or on the resolution of any request for an equitable adjustment in the Contract Sum as provided in Section 7.02 or the Contract Time as provided in Section 7.03, Contractor's only remedy shall be to file a Claim with Owner as provided in this section.

B. Claim filing deadline for Contractor: Contractor shall file its Claim within 120 Days from Owner's final offer made in accordance with paragraph 7.01E, or by the date of Final Acceptance, whichever occurs first.

C. Claim must cover all costs and be documented: The Claim shall be deemed to cover all changes in cost and time (including direct, indirect, impact, and consequential) to which Contractor may be entitled. It shall be fully substantiated and documented. At a minimum, the Claim shall contain the following information:

1. Factual statement of Claim: A detailed factual statement of the Claim for additional compensation and time, if any, providing all necessary dates, locations, and items of Work affected by the Claim;

2. Dates: The date on which facts arose which gave rise to the Claim;

3. Owner and A/E employee's knowledgeable about Claim: The name of each employee of Owner or A/E knowledgeable about the Claim;

4. Support from Contract Documents: The specific provisions of the Contract Documents which support the Claim;

5. Identification of other supporting information: The identification of any documents and the substance of any oral communications that support the Claim;

6. Copies of supporting documentation: Copies of any identified documents, other than the Contract Documents, that support the Claim;

7. Details on Claim for Contract Time: If an adjustment in the Contract Time is sought: the specific days and dates for which it is sought; the specific reasons Contractor believes an extension in the Contract Time should be granted; and Contractor's analysis of its Progress Schedule to demonstrate the reason for the extension in Contract Time;

8. Details on Claim for adjustment of Contract Sum: If an adjustment in the Contract Sum is sought, the exact amount sought and a breakdown of that amount into the categories set forth in, and in the detail as required by Section 7.02; and

9. Statement certifying Claim: A statement certifying, under penalty of perjury, that the Claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of Contractor's knowledge and belief, that the Claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Sum or Contract Time for which Contractor believes Owner is liable.

D. Owner's response to Claim filed: After Contractor has submitted a fully documented Claim that complies with all applicable provisions of Parts 7 and 8, Owner shall respond, in writing, to Contractor as follows:

1. Response time for Claim less than $50,000: If the Claim amount is less than $50,000, with a decision within 60 Days from the date the Claim is received; or

2. Response time for Claim of $50,000 or more: If the Claim amount is $50,000 or more, with a decision within 60 Days from the date the Claim is received, or with notice to Contractor of the date by which it will render its decision. Owner will then respond with a written decision in such additional time.

E. Owner's review of Claim and finality of decision: To assist in the review of Contractor's Claim, Owner may visit the Project site, or request additional information, in order to fully evaluate the issues raised by the Claim. Contractor shall proceed with performance of the Work pending final resolution of any Claim. Owner's written decision as set forth above shall be final and conclusive as to all matters set forth in the Claim, unless Contractor follows the procedure set forth in Section 8.02.

F. Waiver of Contractor rights for failure to comply with this Section: Any Claim of the Contractor against the Owner for damages, additional compensation, or additional time, shall be conclusively deemed to have been waived by the Contractor unless made in accordance with the requirements of this Section.

8.02 ARBITRATION

A. Timing of Contractor's demand for arbitration: If Contractor disagrees with Owner's decision rendered in accordance with paragraph 8.01D, Contractor shall provide Owner with a written demand for arbitration. No demand for arbitration of any such Claim shall be made later than 30 Days after the date of Owner's decision on such Claim; failure to demand arbitration within said 30 Day period shall result in Owner's decision being final and binding upon Contractor and its Subcontractors.

B. Filing of Notice for arbitration: Notice of the demand for arbitration shall be filed with the American Arbitration Association (AAA), with a copy provided to Owner. The parties shall negotiate or mediate under the Voluntary Construction Mediation Rules of the AAA, or mutually acceptable service, before seeking arbitration in accordance with the Construction Industry Arbitration Rules of AAA as follows:

1. Claims less than $30,000: Disputes involving $30,000 or less shall be conducted in accordance with the Northwest Region Expedited Commercial Arbitration Rules; or

2. Claims greater than $30,000: Disputes over $30,000 shall be conducted in accordance with the Construction Industry Arbitration Rules of the AAA, unless the parties agree to use the expedited rules.

C. Arbitration is forum for resolving Claims: All Claims arising out of the Work shall be resolved by arbitration. The judgment upon the arbitration award may be entered, or review of the award may

occur, in the superior court having jurisdiction thereof. No independent legal action relating to or arising from the Work shall be maintained.

D. Owner may combine Claims into same arbitration: Claims between Owner and Contractor, Contractor and its Subcontractors, Contractor and A/E, and Owner and A/E shall, upon demand by Owner, be submitted in the same arbitration or mediation.

E. Settlement outside of arbitration to be documented in Change Order: If the parties resolve the Claim prior to arbitration judgment, the terms of the resolution shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of the Claim, including all claims for time and for direct, indirect, or consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity.

8.03 CLAIMS AUDITS

A. Owner may audit Claims: All Claims filed against Owner shall be subject to audit at any time following the filing of the Claim. Failure of Contractor, or Subcontractors of any tier, to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim or to permit Owner access to the books and records of Contractor, or Subcontractors of any tier, shall constitute a waiver of the Claim and shall bar any recovery.

B. Contractor to make documents available: In support of Owner audit of any Claim, Contractor shall, upon request, promptly make available to Owner the following documents:

1. Daily time sheets and supervisor's daily reports;
2. Collective bargaining agreements;
3. Insurance, welfare, and benefits records;
4. Payroll registers;
5. Earnings records;
6. Payroll tax forms;
7. Material invoices, requisitions, and delivery confirmations;
8. Material cost distribution worksheet;
9. Equipment records (list of company equipment, rates, etc.);
10. Vendors', rental agencies', Subcontractors', and agents' invoices;
11. Contracts between Contractor and each of its Subcontractors, and all lower-tier Subcontractor contracts and supplier contracts;
12. Subcontractors' and agents' payment certificates;
13. Cancelled checks (payroll and vendors);
14. Job cost report, including monthly totals;
15. Job payroll ledger;
16. Planned resource loading schedules and summaries;

17. General ledger;

18. Cash disbursements journal;

19. Financial statements for all years reflecting the operations on the Work. In addition, the Owner may require, if it deems it appropriate, additional financial statements for 3 years preceding execution of the Work;

20. Depreciation records on all company equipment whether these records are maintained by the company involved, its accountant, or others;

21. If a source other than depreciation records is used to develop costs for Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents;

22. All nonprivileged documents which relate to each and every Claim together with all documents which support the amount of any adjustment in Contract Sum or Contract Time sought by each Claim;

23. Work sheets or software used to prepare the Claim establishing the cost components for items of the Claim including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors, all documents which establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals; and

24. Work sheets, software, and all other documents used by Contractor to prepare its bid.

C. Contractor to provide facilities for audit and shall cooperate: The audit may be performed by employees of Owner or a representative of Owner. Contractor, and its Subcontractors, shall provide adequate facilities acceptable to Owner, for the audit during normal business hours. Contractor, and all Subcontractors, shall make a good faith effort to cooperate with Owner's auditors.

PART 9 – TERMINATION OF THE WORK

9.01 TERMINATION BY OWNER FOR CAUSE

A. 7 Day Notice to Terminate for Cause: Owner may, upon 7 Days written notice to Contractor and to its surety, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for cause upon the occurrence of any one or more of the following events:

1. Contractor fails to prosecute Work: Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time;

2. Contractor bankrupt: Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of its insolvency;

3. Contractor fails to correct Work: Contractor fails in a material way to replace or correct Work not in conformance with the Contract Documents;

4. Contractor fails to supply workers or materials: Contractor repeatedly fails to supply skilled workers or proper materials or equipment;

5. Contractor failure to pay Subcontractors or labor: Contractor repeatedly fails to make prompt payment due to Subcontractors or for labor;

6. Contractor violates laws: Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or

7. Contractor in material breach of Contract: Contractor is otherwise in material breach of any provision of the Contract Documents.

B. Owner's actions upon termination: Upon termination, Owner may at its option:

1. Take possession of Project site: Take possession of the Project site and take possession of or use all materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor to maintain the orderly progress of, and to finish, the Work;

2. Accept assignment of Subcontracts: Accept assignment of subcontracts pursuant to Section 5.20; and

3. Finish the Work: Finish the Work by whatever other reasonable method it deems expedient.

C. Surety's role: Owner's rights and duties upon termination are subject to the prior rights and duties of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

D. Contractor's required actions: When Owner terminates the Work in accordance with this section, Contractor shall take the actions set forth in paragraph 9.02B, and shall not be entitled to receive further payment until the Work is accepted.

E. Contractor to pay for unfinished Work: If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including compensation for A/E's services and expenses made necessary thereby and any other extra costs or damages incurred by Owner in completing the Work, or as a result of Contractor's actions, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to Owner. These obligations for payment shall survive termination.

F. Contractor and Surety still responsible for Work performed: Termination of the Work in accordance with this section shall not relieve Contractor or its surety of any responsibilities for Work performed.

G. Conversion of "Termination for Cause" to "Termination for Convenience": If Owner terminates Contractor for cause and it is later determined that none of the circumstances set forth in paragraph 9.01A exist, then such termination shall be deemed a termination for convenience pursuant to Section 9.02.

9.02 TERMINATION BY OWNER FOR CONVENIENCE

A. Owner Notice of Termination for Convenience: Owner may, upon written notice, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for the convenience of Owner.

B. Contractor response to termination Notice: Unless Owner directs otherwise, after receipt of a written notice of termination for either cause or convenience, Contractor shall promptly:

1. Cease Work: Stop performing Work on the date and as specified in the notice of termination;

2. No further orders or Subcontracts: Place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of such portion of the Work as is not terminated;

3. Cancel orders and Subcontracts: Cancel all orders and subcontracts, upon terms acceptable to Owner, to the extent that they relate to the performance of Work terminated;

4. Assign orders and Subcontracts to Owner: Assign to Owner all of the right, title, and interest of Contractor in all orders and subcontracts;

5. Take action to protect the Work: Take such action as may be necessary or as directed by Owner to preserve and protect the Work, Project site, and any other property related to this Project in the possession of Contractor in which Owner has an interest; and

6. Continue performance not terminated: Continue performance only to the extent not terminated

C. Terms of adjustment in Contract Sum if Contract terminated: If Owner terminates the Work or any portion thereof for convenience, Contractor shall be entitled to make a request for an equitable adjustment for its reasonable direct costs incurred prior to the effective date of the termination, plus reasonable allowance for overhead and profit on Work performed prior to termination, plus the reasonable administrative costs of the termination, but shall not be entitled to any other costs or damages, whatsoever, provided however, the total sum payable upon termination shall not exceed the Contract Sum reduced by prior payments. Contractor shall be required to make its request in accordance with the provisions of Part 7.

D. Owner to determine whether to adjust Contract Time: If Owner terminates the Work or any portion thereof for convenience, the Contract Time shall be adjusted as determined by Owner.

PART 10 – MISCELLANEOUS PROVISIONS

10.01 GOVERNING LAW

Applicable law and venue: The Contract Documents and the rights of the parties herein shall be governed by the laws of the state of Washington. Venue shall be in the county in which Owner's principal place of business is located, unless otherwise specified.

10.02 SUCCESSORS AND ASSIGNS

Bound to successors; Assignment of Contract: Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party shall assign the Work without written consent of the other, except that Contractor may assign the Work for security purposes, to a bank or lending institution authorized to do business in the state of Washington. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations set forth in the Contract Documents.

10.03 MEANING OF WORDS

Meaning of words used in Specifications: Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or to the code of any governmental authority,

whether such reference be specific or by implication, shall be to the latest standard specification, manual, or code in effect on the date for submission of bids, except as may be otherwise specifically stated. Wherever in these Drawings and Specifications an article, device, or piece of equipment is referred to in the singular manner, such reference shall apply to as many such articles as are shown on the drawings, or required to complete the installation.

10.04 RIGHTS AND REMEDIES

No waiver of rights: No action or failure to act by Owner or A/E shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall action or failure to act constitute approval or an acquiescence in a breach therein, except as may be specifically agreed in writing.

10.05 CONTRACTOR REGISTRATION

Contractor must be registered or licensed: Pursuant to RCW 39.06, Contractor shall be registered or licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27.

10.06 TIME COMPUTATIONS

Computing time: When computing any period of time, the day of the event from which the period of time begins shall not be counted. The last day is counted unless it falls on a weekend or legal holiday, in which event the period runs until the end of the next day that is not a weekend or holiday. When the period of time allowed is less than 7 days, intermediate Saturdays, Sundays, and legal holidays are excluded from the computation.

10.07 RECORDS RETENTION

Six year records retention period: The wage, payroll, and cost records of Contractor, and its Subcontractors, and all records subject to audit in accordance with Section 8.03, shall be retained for a period of not less than 6 years after the date of Final Acceptance.

10.08 THIRD-PARTY AGREEMENTS

No third party relationships created: The Contract Documents shall not be construed to create a contractual relationship of any kind between: A/E and Contractor; Owner and any Subcontractor; or any persons other than Owner and Contractor.

10.09 ANTITRUST ASSIGNMENT

Contractor assigns overcharge amounts to Owner: Owner and Contractor recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the purchaser. Therefore, Contractor hereby assigns to Owner any and all claims for such overcharges as to goods, materials, and equipment purchased in connection with the Work performed in accordance with the Contract Documents, except as to overcharges which result from antitrust violations commencing after the Contract Sum is established and which are not passed on to Owner under a Change Order. Contractor shall put a similar clause in its Subcontracts, and require a similar clause in its sub-Subcontracts, such that all claims for such overcharges on the Work are passed to Owner by Contractor.

10.10 HEADINGS AND CAPTIONS

Headings for convenience only: All headings and captions used in these General Conditions are only for convenience of reference, and shall not be used in any way in connection with the meaning, effect, interpretation, construction, or enforcement of the General Conditions, and do not define the limit or describe the scope or intent of any provision of these General Conditions.

SUPPLEMENTAL CONDITIONS
FOR WASHINGTON STATE FACILITIES CONSTRUCTION

(Paragraphs keyed to the State's General Conditions)

2.02 Replaces Section 2.02 – INSURANCE COVERAGE LIMITS and CERTIFICATES

A. Insurance Coverage Certificates and Policies

The Contractor shall furnish acceptable proof of insurance coverage on the state of Washington Certificate of Insurance form SF500A, dated 07/02/92 or ACORD form, as well as copies of insurance policies.

B. Required Insurance Coverages

1. For a contract less than $100,000.00, the coverage required is:

   a. Comprehensive General Liability Insurance – The Contractor shall at all times during the term of this contract, at its cost and expense, carry and maintain general public liability insurance, including contractual liability, against claims for bodily injury, personal injury, death or property damage occurring or arising out of services provided under this contract. This insurance shall cover claims caused by any act, omission, or negligence of the Contractor or its officers, agents, representatives, assigns or servants. The limits of liability insurance, which may be increased as deemed necessary by the contracting parties, shall be:

Each Occurrence	$1,000,000.00
General Aggregate Limits (other than products – commercial operations)	$1,000,000.00
Products – Commercial Operations Limit	$1,000,000.00
Personal and Advertising Injury Limit	$1,000,000.00
Fire Damage Limit (any one fire)	$50,000.00
Medical Expense Limit (any one person)	$5,000.00

   b. If the contract is for underground utility work, then the Contractor shall provide proof of insurance for that above in the form of Explosion, Collapse and Underground (XCU) coverage.

   c. Employers Liability on an occurrence basis in an amount not less than $1,000,000.00 per occurrence.

2. For contracts over $100,000.00 but less than $5,000,000.00 the contractor shall obtain the coverage limits as listed for contracts below $100,000.00 and General Aggregate and Products – Commercial Operations Limit of not less than $2,000,000.00.

3. Coverage for Comprehensive General Bodily Injury Liability Insurance for a contract over $5,000,000.00 is:

Each Occurrence	$2,000,000.00
General Aggregate Limits (other than products – commercial operations)	$4,000,000.00
Products – Commercial Operations limit	$4,000,000.00
Personal and Advertising Injury Limit	$2,000,000.00

Fire Damage Limit (any one fire)	$50,000.00
Medical Expense Limit (any one Person)	$5,000.00

4. For all Contracts – Automobile Liability: in the event that services delivered pursuant to this contract involve the use of vehicles or the transportation of clients, automobile liability insurance shall be required. If Contractor-owned personal vehicles are used, a Business Automobile Policy covering at a minimum Code 2 "owned autos only" must be secured. If Contractor employee's vehicles are used, the Contractor must also include under the Business Automobile Policy Code 9, coverage for non-owned autos. The minimum limits for automobile liability is: $1,000,000.00 per occurrence, using a combined single limit for bodily injury and property damage.

5. For Contracts for Hazardous Substance Removal (Asbestos Abatement, PCB Abatement, etc.)

   a. In addition to providing insurance coverage for the project as outlined above, the Contractor shall provide Pollution Liability insurance for the hazardous substance removal as follows:

EACH OCCURRENCE	AGGREGATE
$500,000.00	$1,000,000.00

   or $1,000,000.00 each occurrence/aggregate bodily injury and property damage combined single limit.

   1) Insurance certificate must state that the insurer is covering hazardous substance removal.
   2) Should this insurance be secured on a "claims made" basis, the coverage must be continuously maintained for one year following the project's "final completion" through official completion of the project, plus one year following.

   For Contracts where hazardous substance removal is a subcomponent of contracted work, the general contractor shall provide to the Owner a certificate of insurance for coverage as defined in 5a. above. The State of Washington must be listed as an additional insured. This certificate of insurance must be provided to the Owner prior to commencing work.

2.04 Replaces Section 2.04 - PAYMENT AND PERFORMANCE BONDS

Conditions for bonds: Payment and performance bonds for 100% of the Contract Award Amount, plus state sales tax, shall be furnished for the Work, using the Payment Bond and Performance Bond form published by and available from the American Institute of Architects (AIA) – form A312. Prior to execution of a Change Order that, cumulatively with previous Change Orders, increases the Contract Award Amount by 15% or more, the Contractor shall provide either new payment and performance bonds for the revised Contract Sum, or riders to the existing payment and performance bonds increasing the amount of the bonds. The Contractor shall likewise provide additional bonds or riders when subsequent Change Orders increase the Contract Sum by 15% or more.

No payment or performance bond is required if the Contract Sum is $150,000 or less and the Contractor or General Contractor/Construction Manager agrees that Owner may, in lieu of the bond, retain 10% of the Contract Sum for the period allowed by RCW 39.08.010.

3.02 Replaces Section 3.02 B – CONSTRUCTION SCHEDULE

B. Form of Progress Schedule: The Progress Schedule shall be in the form of a Critical Path Method (CPM) logic network or, with the approval of the Owner, a bar chart schedule may be submitted. The scheduling of construction is the responsibility of the Contractor and is included in the contract to assure adequate planning and execution of the work. The schedule will be used to evaluate progress of the work for payment based on the Schedule of Values. The schedule shall show the Contractor's planned order and interdependence of activities, and sequence of work. As a minimum the schedule shall include:

1. Date of Notice to Proceed;
2. Activities (resources, durations, individual responsible for activity, early starts, late starts, early finishes, late finishes, etc.);
3. Utility Shutdowns;
4. Interrelationships and dependence of activities;
5. Planned vs. actual status for each activity;
6. Substantial completion;
7. Punch list;
8. Final inspection;
9. Final completion, and
10. Float time

The Schedule Duration shall be based on the Contract Time of Completion listed on the Bid Form. The Owner shall not be obligated to accept any Early Completion Schedule suggested by the Contractor. The Contract Time for Completion shall establish the Schedule Completion Date.

If the Contractor feels that the work can be completed in less than the Specified Contract Time, then the Surplus Time shall be considered Project Float. This Float time shall be shown on the Project Schedule. It shall be available to accommodate changes in the work and unforeseen conditions.

Neither the Contractor nor the Owner have exclusive right to this Float Time. It belongs to the project.

5.01 Replaces Section 5.01 B & D - CONTRACTOR CONTROL AND SUPERVISION

B. Competent Superintendent required: Performance of the Work shall be directly supervised by a competent superintendent who has authority to act for Contractor. The superintendent must be satisfactory to the Owner and shall not be changed without the prior written consent of Owner. Owner may require Contractor to remove the superintendent from the Work or Project site, at no cost to the Owner for delay or any other claim, if Owner reasonably deems the superintendent incompetent, negligent, or otherwise objectionable, provided Owner has first notified Contractor in writing and allowed a reasonable period for transition. Noncompliance with the Owner's request to remove and replace the superintendent for a material reason shall also be grounds for terminating the Contract for cause.

D. Contractor to employ competent and disciplined workforce: Contractor shall enforce strict discipline and good order among all of the Contractor's employees and other persons performing the Work. Contractor shall not permit employment of persons not skilled in tasks assigned to them. Contractor's employees shall at all times conduct business in a manner which assures fair, equal, and nondiscriminatory treatment of all persons. Owner may, by written notice, require Contractor to remove from the Work or Project site, at no cost to the Owner for delay or any other claim, any employee Owner reasonably deems incompetent,

negligent, or otherwise objectionable. Noncompliance with the Owner's request to remove and replace personnel at any level for a material reason shall also be grounds for terminating the Contract for cause.

5.02 Replaces Section 5.02 B – PERMITS, FEES AND NOTICES

B. Allowances for permit fees: The actual cost of the general building permit (only) and the public utility hook-up fees will be a direct reimbursement to the Contractor or paid ***directly to the permitting agency*** *by the Owner.* ***Fees for these permits should not be included by the Contractor in his bid amount***

Add New Section 5.02 D – PERMITS, FEES, AND NOTICES

D. Contractor to submit copies: The General Contractor shall submit copies of each valid permit required on the project to the Owner's representative. Nothing in this part shall be construed as imposing a duty upon the Owner or A/E to secure permits.

5.04 Replaces 5.04, Section A – PREVAILING WAGES

A. Contractor to pay Prevailing Wages or applicable Federal Wages: Contractor shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work, is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor's responsibility to verify the applicable prevailing wage rate. If applicable, the Contractor shall comply with all Federal Funding requirements of the Davis Bacon Act that will be addressed in a separate "DIVISION 00 SPECIAL CONDITIONS" specification section that will be based on the specific requirements of the funding source. .

5.04 Replaces 5.04, Section G – Certified Payrolls

G. Certified Payrolls: Consistent with WAC 296-127-320, the Contractor and any subcontractor shall submit a certified copy of payroll records if requested. If applicable, the Contractor shall comply with all Federal Funding requirements of the Davis Bacon Act that will be addressed in a separate "DIVISION 00 SPECIAL CONDITIONS" specification section that will be based on the specific requirements of the funding source.

5.06 Replaces 5.06, Section A – NONDISCRIMINATION

A. Discrimination prohibited by applicable laws: The Contractor and all Subcontractors shall comply with all applicable federal and state non-discrimination laws, regulations, and policies. No person shall, on the grounds of age, race, creed, color, sex, sexual orientation, religion, national origin, marital status, honorably discharged veteran or military status, or disability (physical, mental, or sensory) be denied the benefits of, or otherwise be subjected to discrimination under any project, program, or activity, funded, in whole or in part, under this Agreement.

5.07 Replaces 5.07, Section A – SAFETY PRECAUTIONS

A. In performing this contract, the Contractor shall provide for protecting the lives and health of employees and other persons; preventing damage to property, materials, supplies, and equipment; and avoid work interruptions. For these purposes, the Contractor shall:

1. Follow Washington Industrial Safety and Health Act (WISHA) regional directives and provide a site-specific safety program that will require an accident prevention and hazard analysis plan for the contractor and each subcontractor on the work site. The Contractor shall submit a site-specific safety plan to the Owner's representative prior to the initial scheduled construction meeting.

2. Provide adequate safety devices and measures including, but not limited to, the appropriate safety literature, notice, training, permits, placement and use of barricades, signs, signal lights, ladders, scaffolding, staging, runways, hoist, construction elevators, shoring, temporary lighting, grounded outlets, wiring, hazardous materials, vehicles, construction processes, and equipment required by all applicable state, federal, and local laws and regulations.

3. Comply with the State Environmental Policy Act (SEPA), Clean Air Act, Shoreline Management Act, and other applicable federal, state, and local statutes and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources.

4. Post all permits, notices, and/or approvals in a conspicuous location at the construction site.

5. Provide any additional measures that the Owner determines to be reasonable and necessary for ensuring a safe environment in areas open to the public. Nothing in this part shall be construed as imposing a duty upon the Owner or A/E to prescribe safety conditions relating to employees, public, or agents of the Contractors.

5.20 Add New Paragraph A. 6. – SUBCONTRACTORS AND SUPPLIERS

6. Within the three-year period immediately preceding the date of the bid solicitation, not have been determined by a final and binding citation and notice of assessment issued by the department of labor and industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW.

5.20 Replace Paragraph B – SUBCONTRACTORS AND SUPPLIERS

B. Use qualified Subcontractors: Contractor shall utilize Subcontractors and suppliers, which are experienced and qualified, and meet the requirements of the Contract Documents, if any. Contractor shall not utilize any Subcontractor or supplier to whom the Owner has a reasonable objection, and shall obtain Owner's written consent before making any substitutions or additions.

7.02 Replace Paragraph B.7.c – CHANGE IN THE CONTRACT SUM, Change Order Pricing – Fixed Price, Components of Increased Cost

c. Equipment costs: This is an itemization of the type of equipment and the estimated or actual length of time the construction equipment appropriate for the Work is or will be

used on the change in the Work. Costs will be allowed for construction equipment only if used solely for the changed Work, or for additional rental costs actually incurred by the Contractor. Equipment charges shall be computed on the basis of actual invoice costs or if owned, from the current edition of one of the following sources:

(1) The National Electrical Contractors Association for equipment used on electrical work.

(2) The Mechanical Contractors Association of America for equipment used on mechanical work.

(3) The EquipmentWatch Fleet Manager Estimator Package (digital). The maximum rate for standby equipment shall not exceed that shown in the Associated General Contractors Washington State Department of Transportation (AGC WSDOT) Equipment Rental Agreement, current edition on the Contract execution date.

10.11 Add Part 10.11 – DIVERSE BUSINESS PARTICIPATION

The state of Washington encourages participation in all of its contracts by Diverse Businesses as found in RCW Chapters 39, 43, and WAC 326. The voluntary Diverse Business goal of 26%, which is an aggregate of: 10% Minority Business Enterprises (MBE), 6% Women Business Enterprises (WBE), 5% Veteran-owned Business, and 5% Washington Small Businesses self-identified in the Washington Electronic Business Solution (WEBS) http://www.des.wa.gov/services/ContractingPurchasing/Business/Pages/WEBSRegistration.aspx. Contractors are encouraged to meet or exceed the project goals in the advertisement by any level of participation, regardless of category.

DES reserves the right to adjust the voluntary participation goals.

Businesses are encouraged to register in WEBS, as well as registering as a state certified M/WBE/Veteran Business.

For reporting, Contractor is required to register and create an account in the DES Diversity Compliance Program (B2GNow) at https://des.diversitycompliance.com/.

Every month for the duration of your contract, and while your contract is active in the B2Gnow system, submit and accurately maintain the following information through B2Gnow:

a. Payments received by the prime contractor from the Agency
b. Payments paid to each subcontractor
c. Payments paid to each supplier

You must also ensure the following information is reported in the B2Gnow system by your subcontractors and lower-tier subcontractors for the duration of your contract:

a. Confirmation of payments from the prime contractor to the subcontractor
b. Payment reporting to 2nd tier (and lower) subcontractors

10.12 Add Part 10.12 - MINIMUM LEVELS OF APPRENTICESHIP PARTICIPATION

In accordance with RCW 39.04.320, the State of Washington requires 15% apprenticeship participation for projects estimated to cost one million dollars or more.

A. Apprentice participation, under this contract, may be counted towards the required percentage (%) only if the apprentices are from an apprenticeship program registered and approved by the Washington State Apprenticeship and Training Council (RCW 49.04 and WAC 296-05).

B. Bidders may contact the Department of Labor and Industries, Specialty Compliance Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530 by phone at (360) 902-5320, and e-mail at Apprentice@Lni.wa.gov, to obtain information on available apprenticeship programs.

C. For each project that has apprentice requirements, the contractor shall submit a **"Statement of Apprentice and Journeyman Participation"** on forms provided by the Department of Enterprise Services, with every request for progress payment. The Contractor shall submit consolidated and cumulative data collected by the Contractor and collected from all subcontractors by the Contractor. The data to be collected and submitted includes the following:

11. Contractor name and address
12. Contract number
13. Project name
14. Contract value
15. Reporting period "Beginning Date" through "End Date"
16. Name and registration number of each apprentice by contractor
17. Total number of apprentices and labor hours worked by them, categorized by trade or craft
18. Total number of journeymen and labor hours worked by them, categorized by trade or craft
19. Cumulative combined total of apprentice and journeymen labor hours
20. Total percentage of apprentice hours worked

D. No changes to the required percentage (%) of apprentice participation shall be allowed without written approval of the Owner. In any request for the change, the Contractor shall clearly demonstrate a good faith effort to comply with the requirements for apprentice participation.

E. Any substantive violation of the mandatory requirements of this part of the contract may be a material breach of the contract by the Contractor. The Owner may withhold payment pursuant to Part 6.05, stop the work for cause pursuant to Part 3.04, and terminate the contract for cause pursuant to Part 9.01.

10.13 Add Part 10.13 – SPECIAL CONDITIONS

The Owner may have Federal Funding or other special requirements for this project. If applicable, the Contractor will be required to comply with the "DIVISION 00 SPECIAL CONDITIONS" section in the specifications that will be based on the specific requirements of the funding source.

SECTION 002119 – INFORMATION AVAILABLE TO BIDDERS

PART 1 - GENERAL

1.1 REPORTS

A. Geotechnical Engineering Investigation – Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report, dated September 27, 2017, prepared by Associated Earth Sciences, Inc., and included herein.

1.2 AVAILABILITY

A. Copies of these reports are available for purchase from the office of the Bidding Documents printer and distributor. Three (3) days prior notice is required to accommodate printing requests.

1. Geotechnical Engineering Investigation is bound herein.

B. These documents may also be viewed at the office of NAC Architecture.

1.3 PURPOSE

A. The documents are being made available for “information only.”

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 002119

Project Name: **Western State Hospital - New Kitchen Commissary Pharmacy** Project No.: **2016-410 G (2-1)**

Contractor Name: _____

STATE OF WASHINGTON
DEPARTMENT OF ENTERPRISE SERVICES
ENGINEERING & ARCHITECTURAL SERVICES
MAIL TO: PO BOX 41476, OLYMPIA, WA 98504-1476
HAND DELIVER TO: SHIPPING & RECEIVING ROOM NO. 1140
(STOP AT LOBBY FOR DIRECTIONS)
1500 JEFFERSON ST. SE
OLYMPIA, WASHINGTON 98501

BID FORM

In compliance with the contract documents, the following bid form is submitted:

1) BASE BID (*Including Trench Excavation Safety Provisions)*

_____ $_____
(Please print dollar amount in space above) **(do not include Washington State Sales Tax)**

TRENCH EXCAVATION SAFETY PROVISIONS $ _____
(*Included also in Base Bid*)

If the bid amount contains any work which requires trenching exceeding a depth of four feet, all costs for trench safety shall be included in the Base Bid **and indicated above** for adequate trench safety systems in compliance with Chapter 39.04 RCW. 49.17 RCW and WAC 296-155-650. Bidder must include a lump sum dollar amount in blank above (even if the value is $0.00) to be responsive.

---

2) BID ALTERNATES *(Specify whether additive or deductive)*

(1A) Provide Controls System by Andover $_____

(1B) Provide Controls Sytem by Johnson Controls $_____

(2) Add DAS System $_____

(3) Add Lane Widening $_____

(4) Pave Employee Parking Lot $_____

Do not include Washington State Sales Tax **in alternate amounts**.

The Owner reserves the right to accept or reject any or all bid prices within sixty (60) days of the bid date.

3) TIME FOR COMPLETION:

Contract Time - The undersigned hereby agrees to Substantially Complete all the work under the Base Bid (and accepted Alternates) within 480 calendar days after the date of Notice to Proceed. The Contract Time includes an initial 30 calendar day pre-construction period to facilitate required background checks and identification badging.

Final Completion – All the Work shall be fully and finally completed in accordance with the contract documents within 60 calendar days after the date of Substantial Completion.

4) UNIT PRICES *(Where applicable) (Do not include Washington State Sales Tax)*

Item No.	Unit Description	Estimated Quantities	Additive Unit Price	Deductive Unit Price	Per Measurement
1. UP-1	Unsuitable Soil	250 CY	$	$	
2. UP-2	Structural Fill	250 CY	$	$	
3. UP-3	*Structural Fill*	*50 CY*	*$*	*$*	

(Addendum 1)

The above unit prices shall be for any additive and deductive work within 15% of the above estimated quantities. The unit price shall include full compensation for the cost of labor, materials, equipment, overhead, profit and any additional costs associated with the unit bid.

The Owner reserves the right to accept or reject any or all unit prices within sixty (60) days of the bid date. Unit prices not accepted within 60 days of the bid date are rejected.

5) SUBCONTRACTOR LISTING – RCW 39.30.060

If the base bid and the sum of the additive alternates is one million dollars or more, the Bidder shall provide names of the subcontractors with whom the Bidder will **directly** subcontract for performance of the following work. If the Bidder intends to perform the work, the Bidder must enter its name for that category of work.

The Bidder shall not list more than one subcontractor for each category of work identified UNLESS subcontractors vary with bid alternates, in which case the Bidder must indicate which subcontractor will be used for which alternate.

Failure of the Bidder to submit the NAMES of such subcontractors or to name itself to perform such work shall render the Bidder's bid nonresponsive and, therefore, VOID.

	Designated Work	**Firm Name**
1.	HVAC	_____
1.a.	HVAC Alternate Bid #____ (if applicable)	
2.	Plumbing	_____
2.a.	Plumbing Alternate Bid #____ (if applicable)	

Contractor Name: _____

Designated Work	**Firm Name**
3. Electrical	_____

3.a. Electrical Alternate Bid #____
(if applicable)

Bidder may attach a separate sheet for additional alternate bid subcontractors.

6) APPRENTICESHIP REQUIREMENTS
The apprentice labor hours required for this project are 15% of the total labor hours. The undersigned agrees to utilize this level of apprentice participation.

7) FEDERAL AND STATE REQUIREMENTS
The undersigned agrees to perform the requirements set out and incorporated by reference in attached "DIVISION 00 SPECIAL CONDITIONS" section in the specifications, if applicable.

8) LIQUIDATED DAMAGES
The undersigned agrees to pay the Owner as liquidated damages the sum of $350.00 for each consecutive calendar day that is in default after the Contract Time. Liquidated damages shall be deducted from the contract invoice after taxes and retainage.

9) RECEIPT OF ADDENDA
Receipt of the following addenda is acknowledged:

Addendum No. _____	Addendum No. _____
Addendum No. _____	Addendum No. _____
Addendum No. _____	Addendum No. _____

Name of Firm _____
NOTE: *If Bidder is a corporation, write State of Incorporation; if a partnership, give full names and addresses of all parties below.*

Signed by _____ Official Capacity _____

Print Name _____

Address _____

City _____ State _____ Zip Code _____

Date _____ Telephone _____ FAX _____

State of Washington Contractor's License No. _____

Federal Tax ID # _____ E-mail address: _____

Employment Security Department No. _____

CONTRACTOR CERTIFICATION
WAGE THEFT PREVENTION – RESPONSIBLE BIDDER CRITERIA
WASHINGTON STATE PUBLIC WORKS CONTRACTS

Prior to awarding a public works contract, the Washington State Department of Enterprise Services is required to determine that a bidder meets the responsibility criteria to be considered a 'responsible bidder' and is qualified to be awarded a public works project. See RCW 39.04.350(1)(g) & (2). Pursuant to legislative enactment in 2017, the responsibility criteria include a contractor certification that the contractor has not willfully violated Washington's wage laws. See Chap. 258, 2017 Laws (enacting SSB 5301).

Project No.: _____

Project Name: _____

Procurement Solicitation Date: _____

I hereby certify, on behalf of the firm identified below, as follows (check one):

☐ **NO WAGE VIOLATIONS.** This firm has NOT been determined by a final and binding citation and notice of assessment issued by the Washington Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of RCW chapters 49.46, 49.48, or 49.52 within three (3) years prior to the date of the above-referenced procurement solicitation date.

OR

☐ **VIOLATIONS OF WAGE LAWS.** This firm has been determined by a final and binding citation and notice of assessment issued by the Washington Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, a provision of RCW chapters 49.46, 49.48, or 49.52 within three (3) years prior to the date of the above-referenced procurement solicitation date.

I hereby certify, under penalty of perjury under the laws of the State of Washington, that the certifications herein are true and correct and that I am authorized to make these certifications on behalf of the firm listed herein.

FIRM NAME: _____
Name of Contractor/Bidder – Print full legal entity name of firm

By: _____ _____
Signature of authorized person Print Name of person making certifications for firm

Title: _____ Place: _____
Title of person signing certificate Print city and state where signed

Date: _____

Return this signed "Contractor Certification" with your signed Bid Form.

Form
S.F. 500 A
(7/2/92)

State of Washington

CERTIFICATE OF INSURANCE

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURED (Legal name and business address)	CERTIFICATE HOLDER: STATE OF WASHINGTON DEPT. OF ENTERPRISE SERVICES DIVISION OF E&A SERVICES 1500 JEFFERSON STREET SE OLYMPIA, WASHINGTON 98501	CONTRACT NUMBER DATE ISSUED:

PROJECT DESCRIPTION / LOCATIONS / VEHICLES / RESTRICTIONS / SPECIAL ITEMS:

This is to certify that policies of Insurance listed below have been issued to the Insured named above for the policy period indicated.

CO LTR	TYPE OF INSURANCE	POLICY NUMBER	Date Policy Effective (MM/DD/YY)	Date Policy Expires (MM/DD/YY)	ALL LIMITS IN THOUSANDS
	GENERAL LIABILITY ☐ Commercial General Liability ☐ Claims Made ☐ Occurrence ☐ Owner's & Contractors Protection ☐ _____ ☐ Deductible $				General Aggregate $ Products Comp/Ops Aggregate $ Personal & Advertising Injury $ Each Occurrence $ Fire Damage (Any One Fire) $ Medical Expense (Any One Person) $
	AUTOMOBILE LIABILITY ☐ Any Auto ☐ All Owned Autos ☐ Scheduled Autos ☐ Hired Autos ☐ Non-Owned Autos ☐ Garage Liability ☐ Deductible $				CSL $ Bodily Injury (per person) $ Bodily Injury (per accident) $ Property Damage $
	EXCESS LIABILITY ☐ ☐ Other Than Umbrella Form				Each Occurrence $ Aggregate $
	WORKERS COMPENSATION AND EMPLOYER'S LIABILITY				STATUTORY $ (Each Accident) $ (Disease Policy Limit) $ (Disease-Each Employee)
	OTHER				

ADDITIONAL PROVISIONS

The State of Washington is included as additional insured as related to the above mentioned project.
Should any of the above described policies be cancelled before the expiration date thereof, the issuing Company must deliver or mail not less than a 45 days written notice to the above Certificate Holder, per RCW 48.18.290

COMPANIES AFFORDING COVERAGE		ISSUING COMPANY, AGENT OR REPRESENTATIVE	
NOTE: Attach a separate sheet to this certificate giving all the company names and their percentage of coverage, if clarification is needed,		NAME:	
Company Letter	A	ADDRESS:	
	B		
	C	Authorized Signature	
	D	Title	
	E	Signature Date	
		Signee Name	
		Telephone No.	

Division 00
Supplemental Bidder
Responsibility Criteria
(With Inclusion Plan and Apprenticeship Requirements)

Low Responsible Bidder

It is the intent of the Owner to award a contract to the lowest responsive and responsible Bidder. In determining the Bidder's responsibility, the Owner shall consider an overall accounting of the items listed below. Potential Bidders may request the Owner modify the Bidder responsibility criteria. The request must be in writing and submitted at least 7 days prior to the bid opening.

The apparent low bidder shall submit the required information within **two (2)** business days of receiving request from Owner. This request may be made in the form of a telephone call or email message. The required information shall be provided on the referenced forms bound herein. Electronic copies may be made available upon request. Failure to submit such information to the satisfaction of the Owner within the time provided may render the Bidder as not responsible.

Required Information/Criteria

For the purposes of the Supplemental Bidder Responsibility evaluation process, the scope of this project generally involves construction of a new Patient Support Services building on an operational psychiatric hospital campus.

1. **Experience of Contractor on Projects of Similar Size and Complexity**
   Contractor is required to have successfully completed at least five projects of similar type, size and complexity to this project, each with a contract amount of at least $10,000,000 within the last five years.

   List of Completed Projects (Use Form 1, Contractor Experience Detail)
   Provide a list of all the construction contracts $10,000,000 and above your firm has completed within the past 10 years, giving the name of the project; name, address, and phone numbers of Owner and architect representatives; final contract amount; date of completion; and percentage of the cost of the work performed with your firm's own forces. This information will be used for reference reviews.

2. **Experience of Key Personnel**

   Experience of Project Manager (Use Form 2, Résumé of Key Personnel for Proposed Contract)
   Submit resume and references for the proposed Project Manager. This person shall have managed, as lead project manager, a minimum of five projects of similar type, size and complexity to this project, and successfully completed those projects within the last 10 years.

Experience of Superintendent (Use Form 2, Résumé of Key Personnel for Proposed Contract)
Submit resume and references for the proposed project Superintendent. This person shall have performed as the lead Superintendent for a minimum of five projects of similar type, size and complexity to this project, and successfully completed those projects within the last 10 years.

3. **Diverse Business Inclusion Plan (Use Form 3)**
   Washington state goals are: Minority Business Enterprise (MBE) 10%, Women's Business Enterprise (WBE) 6%, WA Small Business 5% and WA Veterans 5%. The apparent low bidder is required to submit a Diverse Businesses Inclusion Plan for all projects with a Maximum Allowable Construction Cost (MACC) over $1M.

   The Diverse Business Inclusion plan shall include the apparent low bidder's anticipated participation goals, the subcontractors anticipated to be used on this project, a list of diverse businesses near the project, the project's diverse expert, and past performance using diverse businesses.

4. **Apprenticeship (Use Forms 1 & 4)**
   For each public works project with an apprenticeship utilization goal that was completed by the Bidder within three (3) years of the bid submittal date for this project, the Bidder shall submit the following:

   - A list of such projects;
   - The owner and contact information for the owner's representative;
   - The apprenticeship utilization percentage goal for the project:
   - The actual utilization percentage by the Bidder; and
   - An explanation of any extenuating circumstances that contributed to the Bidder not meeting the goals.

     (Use Form 4 for projects not listed on Form 1)

   The Owner may contact previous owners to validate the information provided by the Bidder and shall consider whether the goals were mandatory or voluntary, and the validity of any explanation of extenuating circumstances.

5. **References from Owners and Architects for Previous Projects (Owner uses Form 5, Reference Evaluation Questionnaire)**
   The Owner may check references by contacting owners and architects of the bidder's previous projects regarding the bidder's performance and that of key staff. A reference score sheet will be utilized and the rating shall be satisfactory or better on a five-category scale with "satisfactory" at mid-scale.

Overall Scoring (Form 6, Responsibility Criteria Evaluation Score Sheet)
The Owner will use this form to complete and document the overall evaluation process.

Supplemental Bidder Responsibility
Form 1 - Contractor Experience Detail
Project No. 2016-410G (2-1), Western State Hospital New Kitchen Commissary Pharmacy

Business Contact Information

Contractor Name:		Total years in Business:
Mailing Address:		
Business Phone:		Former business name(s) & Dates:
Contact Name and Title:		
Contact Phone:	Contact Email:	Reason for name change(s):

*List Projects Completed Within The Time Specified By Division 00, or Are In Progress

* Project Name & Location:	Description Of Project:	Owner:	Architect:	Project Manager Name:	Original Contract Amount:	$	Is this project relevant to proposed project?
					Final Contract Amount:	$	
		Address:	Address:		Original Contract Days		**Yes** ☐
				Superintendent Name:	Time Extensions Granted Days		**No** ☐
		Phone:	Phone:		Completion Date:		
	As Prime ☐ Or Sub: ☐	Email:	Email:				

1. **Did this project require Apprenticeship Participation?**
   Yes ☐ **No** ☐ **(If NO, stop here).**
2. **If yes, what was the Apprenticeship %?** ☐ **%**
3. **What was the actual % achieved?** ☐ **%**
4. **Was the apprenticeship requirement met?**
   Yes ☐ **No** ☐

If **NO** to question 4 attach separate sheet to explain **Why**.

Supplemental Bidder Responsibility
Form 2 - Resume of Key Personnel for Proposed Contract
Project No. 2016-410G (2-1), Western State Hospital New Kitchen Commissary Pharmacy

Name:	Role in this Contract:	Years Experience	
		Total	With Current Firm
Firm Name and Location (City and State):			
Training/Education/Specialization:			
Years of Experience in the Proposed Role:			

RELEVANT PROJECTS	
Project Title:	Year Completed
Project Owner:	
Brief Description (Brief scope, size, cost, etc.) and specific role:	Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:	
Project Owner:	Project Architect:
Name:	Name:
Phone:	Phone:
E-mail	E-mail:

RELEVANT PROJECTS	
Project Title:	Year Completed
Project Owner:	
Brief Description (Brief scope, size, cost, etc.) and specific role:	Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:	
Project Owner:	Project Architect:
Name:	Name:
Phone:	Phone:
E-mail	E-mail:

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

Supplemental Bidder Responsibility
Form 3 - Prime Contractor Diverse Business Inclusion Plan
Project No. 2016-410G (2-1), Western State Hospital New Kitchen Commissary Pharmacy

Prime Contractor Name: _____

For the purposes of this form, Washington State-certified diverse businesses are defined as follows:

- *Minority Business Enterprise (MBE), Women's Business Enterprise (WBE)*, or combination of the two. Certified by the Office of Minority and Women's Business Enterprises (OMWBE): http://omwbe.wa.gov/
- *Veteran-owned Business*. Certified by the Department of Veteran's Affairs (DVA): http://dva.wa.gov/
- *Small Business* (includes Mini and Micro businesses). Certified through the Washington Electronic Business Solution (WEBS): https://fortress.wa.gov/ga/webs/home.html

Anticipated Certified Diverse Business Participation Goals

Subcontracting means direct performance of commercially useful work through subcontracting as part of the proposed project team. Of the total contract work, what are the diverse business participation goals proposed for subcontracting on your team? Please only include the above-listed Washington State certification types in your "Contractor-defined Anticipated Percent of Contract Amount (Goals)" estimate.

Anticipated Certified Diverse Business Participation Goals	Washington State Goals	Contractor-defined Anticipated Percent of Contract Amount (Goals)
Minority-owned business (MBE)	**10%**	**%**
Women-owned business (WBE)	**6%**	**%**
Veteran-owned business (DVA)	**5%**	**%**
Small business	**5%**	**%**

Subcontracting Team

List the names of the diverse businesses you anticipate using on this project. Generally describe the work you expect the diverse business to perform and identify the percent of total contract value intended for each diverse business. Please include the above-listed Washington State certification types. *If necessary, add more rows below.*

Name of Diverse Business	Specify Diverse Business Certification (circle one or more)	Describe Trade or Task	Anticipated Percent of Contract Amount
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%
	MBE, WBE, DVA, Small		%

Attach a list of diverse businesses near the project location to this form:

1. Go to http://omwbe.wa.gov/directory-of-certified-firms/
2. Click on "OMWBE DIRECTORY"
3. Enter a City, Zip Code, or County near the project site address and then press "Search" at the bottom of the page. If you do not have many results, please expand your search to include nearby locations.
4. Print and attach the results to this form with your submittal

Diverse Expert:

Diverse Expert responsibilities would typically include, but are not limited to:

- Outreach to qualified diverse businesses.
- Submit and discuss updates on a regular basis to the state project manager regarding Diverse Business utilization and progress.
- Ongoing outreach to diverse businesses for required contract work, including any changes in scope.

- Assist diverse businesses with successful contract performance.

A qualified Diverse Expert brings knowledge of the identity, capabilities and capacities of diverse business subcontractors and suppliers; experience recruiting and working with diverse businesses for construction; and assisting diverse businesses to develop working relationships with contractors.

Identify the person within your team to manage your diverse inclusion responsibility.

Diverse Expert Name: ____

Diverse Expert Contact Information: ____

Diverse Expert Firm (if another firm is managing participation): ______________________________

Past Performance

Please select **five (5) of your projects** with Washington State-certified diverse business participation (MBE, WBE, DVA, and/or Small/Mini/Micro) and list them below **for the last five (5) years**. If you do not have any projects that tracked or reported diverse business participation, you may leave this section blank. In that case, please attach an additional sheet with explanation.

You may have projects with diverse business participation for an organization or entity that required *different* diverse business categories (including self-certification). If so, please attach a sheet with the same column data and information, but include percentages for the categories that were tracked during the project.

Contract Name	Contracting Agency or Entity	Contract Amount	Year	Percent of Contract Amount	
				Minority-owned business:	%
				Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
				Minority-owned business:	%
		$		Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
				Minority-owned business:	%
		$		Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
				Minority-owned business:	%
		$		Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%
Contract Name	**Contracting Agency or Entity**	**Contract Amount**	**Year**	**Percent of Contract Amount**	
				Minority-owned business:	%
		$		Women-owned business:	%
				Veteran-owned business:	%
				Small/mini/micro business:	%

Supplemental Bidder Responsibility
Form 4 - Apprenticeship Utilization (In addition to Form 1)
Project No. 2016-410G (2-1), Western State Hospital New Kitchen Commissary Pharmacy

Business Contact Information

Contractor Name:		Total years in Business:
Mailing Address:		
Business Phone:		Former business name(s) & Dates:
Contact Name and Title:		
Contact Phone:	Contact Email:	Reason for name change(s):

* Project Name & Location:	Description Of Project:	Owner:	Architect:	Project Manager Name:	Original Contract Amount:	$
					Final Contract Amount:	$
		Address:	Address:		Completion Date:	
		Phone:	Phone:	Superintendent Name:	**1. Did this project require Apprenticeship Participation?** **Yes** ☐ **No** ☐ **(If NO, stop here).** **2. If yes, what was the Apprenticeship %?** **%** **3. What was the actual % achieved?** ☐ **%** **4. Was the apprenticeship requirement met?** **Yes** ☐ **No** ☐ If **NO** to question 4 explain **Why**.	
	As Prime ☐ Or Sub: ☐	Email:	Email:			

Supplemental Bidder Responsibility
Form 5 - Reference Evaluation Questionnaire
Project No. 2016-410G (2-1), Western State Hospital New Kitchen Commissary Pharmacy

Evaluated Firm :
Project Manager:
Superintendent:
Evaluated Project Name:

☐ Prime
☐ Subcontractor

Approx. Start Date	Approx. End Date	Approx. Final Project Cost

PERFORMANCE EVALUATION

Rating Criteria - Rate on a scale of 1 to 5

- **5** = **Superior** based on performance (would hire this firm/individual again)
- **4** = **More than Satisfactory**
- **3** = **Satisfactory** based on performance (would hire this firm/individual again)
- **2** = **Less than Satisfactory**
- **1**= **Totally Unsatisfactory** based on performance (would never hire the firm/individual again)

	Criteria	Rating		
		Company	PM	Super
1	Ability to meet client's expectations			
2	Quality of workmanship			
3	Ability to manage project costs and minimize change orders			
4	Ability to maintain project schedule			
5	Ability to manage subcontractors			
6	Professionalism, leadership and communication in issues management (RFI, shop drawing submittal, timely resolution of issues/questions)			
7	Ability to follow the owner's rules, regulations, and requirements (housekeeping, safety, etc.)			
8	Ability to manage closeout process (Prompt submittal of punch list, warranty, as-builts, operation manuals, tax clearances, etc.)			
9	Comfort level in hiring firm or individual again based on performance			
	Total Score			
	Average Score			

Evaluator Information	
Name of Evaluator:	Title:
Firm/Company Name:	
Firm Address:	
Phone:	Email:

Form 6 – Supplemental Responsibility Criteria Evaluation Score Sheet

Project Title	Western State Hospital New Kitchen Commissary Pharmacy
Project Number	2016-410G (2-1)
Project Manager	Penny Koal, AIA, LEED AP
Project Location	Western State Hospital, 9601 Steilacoom Blvd., Lakewood, WA
Project Owner	Department of Social and Health Services

1. Experience of Contractor - On projects of similar size & complexity (Form 1)	Pass or Fail

2. Experience of Key Personnel (Form 2)	
Superintendent	Pass or Fail
Project Manager	Pass or Fail
Other(s) if specified in Division 00	Pass or Fail

3. Diverse Business Inclusion Plan (Form 3) *(Applies only to projects with Diverse Business Plan Inclusion requirements; i.e. MACC over $1M)*	Pass, Fail, or N/A

4. Contractor Compliance with Apprenticeship Requirements - Requirements were met or if not, a good faith effort was demonstrated (Forms 1 & 4) *Applies only to projects with apprenticeship participation requirements; i.e. MACC over $1M*	Not Scored

5. References from Previous Projects (Form 5) Evaluate contractor's references information and using the rating numbers: 1 = NOT Satisfactory (requires a written comment below) 2 = Less THAN Satisfactory 3 = Satisfactory 4 = More THAN Satisfactory 5 = Superior	Rating **Score 1-5** (3 is Satisfactory)
Company	
Project Manager	
Superintendent	
Total Score:	
Average score (divide total score by number of ratings)	

In determining the bidder responsibility, an overall accounting of the ratings shall be made. A score of "Pass" is required for categories 1 - 4 and an average score of 3.0 or higher is required to meet the minimum Supplemental Bidder Responsibility requirements.

Comments _____

Determination ☐ Responsible
☐ Not Responsible (Preliminary Determination)

Evaluated by _____ Date _____
E&AS PM (Typed or Printed Name)

_____
Signature

SECTION 007400 - PREVAILING WAGE RATES

1.1 PREVAILING WAGE RATES

A. The following prevailing wage rate information is provided in accordance with RCW 39.12.030:

1. Pursuant to RCW 39.12, no worker, laborer, or mechanic shall be paid less than the "prevailing rate of wage" in effect on the Bid Date.

2. Prevailing wage rate information for journeymen and apprentices is available at the Washington State Department of Labor and Industries website at www.lni.wa.gov/tradeslicensing/prevwage.

3. The project is located in Pierce County.

B. Prevailing Wage Rates shall be posted in a conspicuous place or location on the jobsite per RCW 39.12 and Labor and Industries requirements.

END OF SECTION 007300

ss\August 2, 2017

SECTION 011100 - SUMMARY OF WORK

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 PROJECT/WORK IDENTIFICATION

A. The Project name is Western State Hospital New Kitchen Commissary Pharmacy.

B. Project Location is 9601 Steilacoom Blvd., Lakewood, WA 98498.

C. The Owner is Washington State Department of Social and Health Services.

D. Contract Documents are dated January 9, 2018 and were prepared by NAC Architecture, Inc.

E. The Work includes provisions for all supplies, tools, equipment, scaffolding, transportation, utilities, services, superintendence, and labor, and the furnishing of all materials, items, and accessories needed for the total construction of the project in strict conformance with the Contract Documents and to deliver to the Owner complete, operating patient services facility suitable to support operations at a secure psychiatric hospital.

F. The Work will be constructed under a single prime contract.

G. Summary:

1. The Work consists of constructing a new, approximately 48,000 square foot, steel-framed patient services building to be constructed on a site where a building was previously demolished. Previous building was abated and demolished in 2003 and was known as North Hall, Building 7.
2. The Contractor shall understand that this work also includes clearing, grubbing, grading and temporary storm water drainage/control, along with items as noted in the contract documents.
3. The intent of the Contract Documents is that the Contractor will construct a complete, new, fully functional building, related on-site improvements and utility connections, including all civil, architectural, structural, mechanical and electrical improvements, with all materials and equipment in place and all systems operative as defined by the contract documents.

H. Work also includes, but is not limited to:

1. Coordination/cooperation with other contractors/owner’s agents which may be working concurrently on other portions of the site during the project period.
2. Obtaining and paying for use of additional storage, parking or work areas needed for operations.

3. Controlling all movement of water on project site and performing all necessary protection of soils, to prevent erosion of soils, over-saturation of soils, downstream erosion and runoff, etc.
4. Contractor is responsible for controlling dust from leaving site according to all governmental requirements.
5. Coordination/cooperation with other contractors which may or may not be working concurrently on the campus on related projects not delineated within the bounds of this contract.

1.3 SUSTAINABLE DESIGN AND CONSTRUCTION

A. A primary goal for the Owner is to promote and carry out sustainable design and construction on the project.

1. Sustainable design and construction is defined as the materials and methods that preserve landscape, conserve energy, use materials efficiently, enhance environmental quality, and safeguard water.
2. Sustainable design and construction will be evaluated by the US Green Building Council through fulfillment of a LEED Rating for the Project. The Owner requires a LEED Silver Rating for the Project.

B. The Contractor is encouraged to research and select materials, building systems, methods and construction procedures that provide the greatest use of recycled materials, environmentally safe building materials and construction technologies, and to enhance energy efficiency.

1.4 CONTRACTOR USE OF PREMISES

A. General: During the construction period, the Contractor will be working in an occupied and operational secure psychiatric facility. The Contractor shall make themselves familiar with hospital construction limitations and procedures.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Do not unreasonably encumber the site with materials or equipment. If additional storage is necessary obtain and pay for such storage off site.
2. Use of the site does not cover use of adjacent right of ways, public or private property. Consult local jurisdictions or landowners where use of property under their control is considered necessary and conform to their requirements for use thereof.
3. Contractor shall secure all construction areas and activities as necessary to prevent access by the public, staff and patients.

a. Note that while the project site is located outside the secure patient perimeter, some patients may be encountered outside this perimeter.

1.5 SPECIAL PROVISIONS FOR WORKING AT WESTERN STATE HOSPITAL

A. Special attention should be paid to Division 01 Section “Special Provisions” for requirements for working on the campus, required personnel background checks, and other requirements for working at a secure psychiatric hospital.

1.6 CONSTRUCTION WORK HOURS

A. Per the City of Lakewood Municipal Code 8.36.010 (B) (8), sounds originating from construction sites, including but not limited to sounds from construction equipment, power tools and hammering are prohibited between the hours of 10:00 p.m. and 7:00 a.m. on weekdays and 10:00 p.m. and 9:00 a.m. on weekends.

1. The Hospital operates as an around-the-clock, 24/7 inpatient psychiatric institution. Construction noise shall be limited to between the hours of 7:00 a.m. and 7:00 p.m. weekdays and between 9:00 a.m. and 6:00 p.m. on weekends.

1.7 RELATED WORK BY OWNER OR OTHERS

A. NIC & FOIO Items: Items designated on the Drawings and/or described in the Specifications as "NIC" (Not in Contract) or "FOIO" (Furnished by Owner and Installed by Owner) are not included in the Contract.

B. Contractor's Responsibilities for NIC & FOIO Items:

1. Designate delivery date for each portion of the Work in the Progress Schedule.
2. Storage of products as required.
3. Coordinate installation with the Progress Schedule.
4. Provide all preparatory work necessary for proper installation including blocking and backing and finish work including caulking, grouting, furring, preparation of subfloors, and painting adjacent surfaces as required for NIC or FOIO equipment.

a. Notify the Owner 21 days prior to disconnection and/or removal of existing equipment that are to be relocated from existing locations on the campus.

1.8 OWNER FURNISHED PRODUCTS

A. OFCI Items: Items designated on project Drawings and/or described as "OFCI" (Owner Furnished and Contractor Installed).

B. Owner's Responsibilities for OFCI Equipment:

1. Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
2. Deliver supplier's bill of materials to Architect for review.
3. Arrange and pay for delivery to site in accordance with Progress Schedule.
4. Inspect deliveries jointly with Contractor.

5. Submit claims for transportation damage.
6. Arrange for replacement of damaged, defective, or missing items.
7. Arrange for manufacturers' field services; arrange for and deliver manufacturers' warranties and bonds to Contractor.

C. Contractor's Responsibilities for OFCI Equipment:

1. Designate submittals and delivery date for each product in Progress Schedule.
2. Review shop drawings, product data, samples, and other submittals. Submit to Architect with notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
3. Receive and unload products at site.
4. Inspect deliveries jointly with Owner, record shortages and damaged or defective items.
5. Handle products at site, including uncrating and storage.
6. Protect products from damage and from exposure to elements.
7. Assemble, install, connect, adjust, and finish products as stipulated in respective specification sections.
8. Coordinate installation inspections required by public authorities.
9. Clean, repair, or replace items damaged by Contractor.
10. Remove and dispose of crating and packing materials for Owner-furnished materials and equipment delivered to the site.

1.9 VENDOR FIRNISHED PRODUCTS

A. OFVI Items: Items designated on the Drawings and/or described in the Specifications as "OFVI" (Owner Furnished and Vendor Installed) are not included in the Contract, but require coordination by the Contractor for rough-in and installation.

B. Contractor's Responsibilities for OFVI Equipment:

1. Designate submittals and delivery date for each product in Progress Schedule.
2. Review shop drawings, product data, samples, and other submittals. Submit to Architect with notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
3. Receive and unload products at site.
4. Inspect deliveries jointly with Owner, record shortages and damaged or defective items.
5. Handle products at site, including uncrating and storage.
6. Protect products from damage and from exposure to elements.
7. Coordinate final installation of equipment and components with vendors.

1.10 CONTRACTOR DESIGNED ELEMENTS

A. Where work of this Contract requires Contractor design, Contractor shall comply with following requirements.

1. Submit Shop Drawings and calculations to Architect for review.

2. Submit Shop Drawings and calculations to governing agencies for approval and permits.
3. All Shop Drawings and calculations shall be stamped by a registered architect or engineer licensed in State of Washington.

1.11 OWNER OCCUPANCY

A. The site is currently vacant land and an existing parking lot. The Owner will coordinate with the Contractor for access to work areas; however the Contractor will have full responsibility for securing all areas disturbed by construction activities.

1.12 ALTERNATE BID ITEMS

A. The Contractor is to note that the included Alternate Bid items add to the scope of work to be performed. All trades and all divisions of this specification that are affected by the alternate bid items shall be included in the project.

1.13 CONSTRUCTION PHASING GENERAL REQUIREMENTS

A. It is intended the work be completed in a single phase.

1. A four-story concrete and brick ward building was previously located on the project site. The Contractor may encounter limited amounts of small debris during earthwork activities. Notify the Architect if significant debris are encountered.

1.14 CONSTRUCTION COMPLETION DATES

A. The Work shall be Substantially Complete as indicated on the Bid Proposal form.

1.15 WARRANTIES

A. All warranties for the work shall begin as specified in the General Conditions.

1.16 ALTERATIONS AND COORDINATION

A. General: The work of this Contract includes coordination of the entire work of the project, including preparation of general coordination drawings, diagrams and schedules, and control of site utilization, from beginning of construction activity through project close-out and warranty periods. All requests for information shall be submitted through the General Contractor on a form provided by, or approved by, the Owner and the Architect.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 011100

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. This Section includes Allowances incorporated in the Base Bid to address the cost of specific items of work, of unknown quantities at time of Bid, that are likely to be required as a result of the discovery of hidden yet anticipated conditions. The Allowance for each item scheduled herein shall be the product of the Unit Price for that item and the quantity specified herein.

B. Related Sections:

1. Division 01 Section “Unit Prices.”
2. Division 01 Section “Submittal Procedures.”
3. Division 01 Section “Schedule of Values.”

C. Allowances are provided to address hidden conditions only, and are in addition to any and all other work shown on the Drawings or otherwise indicated or implied by the Contract Documents. Allowances, or portions thereof, not used, documented and verified shall be credited to the Owner, by Change Order, following Substantial Completion of the project.

D. Provide Allowances for the Work described herein.

1.3 UNIT PRICE ALLOWANCES

A. Costs included in Allowance:

1. Refer to Division 01 Section “Unit Prices” for included costs.

B. Verification of Quantities

1. Contractor, Architect/Engineer and Owner shall verify and certify all quantities provided as part of each Allowance. Payment shall be made only for those quantities that exceed the Allowance and have been verified and certified by all parties.

C. Architect/Engineer Responsibilities:

1. Prepare Change Orders: In the event that quantities specified in the Allowances are exceeded, the A/E shall prepare Change Orders for an amount determined by the excess quantity and the Unit Price, as previous verified and certified. Following Substantial Completion of the Project, all Allowances will be

reconciled with respect to specified and actual quantities, with any outstanding costs and/or credits incorporated in a Change Order.

D. Contractor Responsibilities:

1. Include stipulated Allowances as part of Base Bid.
2. Submit Shop Drawings, Product Data and Samples in accordance with Division 01 Section "Submittal Procedures."
3. Schedule of Values: Provide individual line items for each Allowance, or each category of Allowances when the two or more Allowances pertain to the same Specification Section and the work is performed by the same contractor or subcontractor.
4. Allowance Log: Contractor shall maintain an Allowance Log. Log shall list each Allowance, corresponding Unit Price and specified quantity, and documentation of units of work expended. Documentation shall be by occurrence and "to date." Space shall be provided for verification and certification by Contractor and A/E. Log shall be distributed and discussed at each weekly meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF UNIT PRICE ALLOWANCES

A. The value of a Unit Price Allowance shall be equal to its specified quantity times its associated Unit Price.

B. Allowance UPA-1: Excavation and Off-site Disposal of 250 Cubic Yards of Unanticipated Unsuitable Soil:

1. The Contractor shall include in its Base Bid all costs associated with the excavation and off-site disposal off 250 cubic yards of unanticipated, unsuitable soil as an Allowance over and above all other Work identified in or reasonably inferred by the Contract Documents.

C. Allowance UPA-2: Import and Place 250 Cubic Yards of Structural Fill:

1. The Contractor shall include in its Base Bid all costs required to import and place 250 cubic yards of structural fill material as an Allowance over and above all other Work identified in or reasonably inferred by the Contract Documents.

D. Allowance UPA-3: Import and Place 50 cubic yards of CDF (controlled density fill)

1. The Contractor shall include in its Base Bid all costs required to import and place 50 cubic yards of controlled density fill as an Allowance over and above all other Work identified in or reasonably inferred by the Contract Documents. (Addendum 1)

END OF SECTION 012100

ss: November 6, 2017

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. This Section includes administrative and procedural requirements pertaining to Unit Prices

B. See Division 01 Section “Allowances” for administrative and procedural requirements for the monitoring, documentation and reconciliation of Allowances determined by Unit Prices, and for the Schedule of Unit Price Allowances.

C. Provide Unit Prices for the Work described herein.

1.3 QUALITY ASSURANCE

A. For each Unit Price item that is performed or provided, coordinate the Work of the various trades involved, and modify surrounding Work as required to complete the project, as intended.

B. Submittals for Unit Price Items shall comply with requirements of Division 01 Section “Submittal Procedures.”

C. See Division 01 Section “Quality Requirements” for general inspection requirements.

D. If there are questions regarding the extent, scope, nature or intent of Unit Price Work, contact the Architect for clarification. Failure on the part of the Contractor to clarify any unclear items shall not relieve the Contractor of the responsibility for performing the Work in accordance with the intent and requirements of the Contract Documents.

1.4 DEFINITIONS

A. A Unit Price is an amount proposed by Bidders and stated on the Bid Form, as a price per unit of measurement for materials added to or deducted from the Base Bid by appropriate modification, if the quantities of Work required by the Contract Documents are increased or decreased. These same Unit Prices shall be used to determine Allowances included in the Base Bid, and subject to reconciliation following Substantial Completion of the Project. The unit prices shall be in effect for all additional material required to be added, or deducted from, the Allowance included in the Base Bid.

B. Unit Prices shall include all labor, material, equipment, overhead, profit, coordination and supervision to complete all the work. Do not include applicable State and Local Sales Taxes, but include all other taxes including, but not limited to, income, excise, and business and occupation taxes.

1.5 PROCEDURES

A. Unit Prices include, but are not limited to, all necessary material, plus cost for delivery, installation, special equipment, temporary facilities and applicable taxes, except sales tax.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections. If not noted, measurement is to be of units in place as noted in this Section. Owner has the right to reject Contractor measurements and to have an independent agent, acceptable to both parties, verify quantities.

C. The "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS

2.1 GENERAL

A. The applicable Sections of the Specifications, and requirements noted on the drawings, apply to the Work under each Unit Price item.

PART 3 - EXECUTION

A. For Unit Prices UP-1 and UP-2: Excavation, material handling, import of structural fill, and disposal of native soil required to establish the planned subgrade elevations shall be included in the base scope of work and is not compensable as a Unit Price. Unanticipated excavation of unanticipated, unsuitable soil below planned subgrades and importing, placement, and compaction of structural fill for approved over-excavation areas will be tracked by the Geotechnical Engineer and stated in the Geotech site reports. Contractor shall review with Geotechnical Engineer all material quantities at the time the materials are handled, and quantities stated in the Geotechnical Engineer's site reports shall be presumed to be accurate and correct.

B. All unanticipated work must have a geotechnical engineer present to verify the scope of the condition. At the end of each day the quantities of each Unit Price will be verified by the geotechnical engineer and reported in the daily geotechnical site reports.

C. Unit Price No. UP-1: Excavation and Off-Site Disposal of Unanticipated Unsuitable Soil:

1. Description: The cost to provide additional excavation, material handling and off-site disposal of un-anticipated, unsuitable native soils below the planned subgrade elevations as directed by the owner's Geotechnical Engineer. This excavation, material handling and disposal is in addition to that required by the Scope of Work described in the Contract Documents.
2. Unit of Measurement: Cubic Yard (CY) of soils excavated, trucked and legally dumped off site, measured from its original compacted and in-place location ("Bank Yards").
3. Unit Price No. UP-1 shall be applied to Unit Price Allowance UPA-1.

D. Unit Price No. UP-2: Import and Place Structural Fill:

1. Description: The cost to provide additional imported structural fill, supplied, placed and compacted to replace unsuitable, unanticipated over-excavated materials compensated in Unit Price UP-1 or as otherwise designated by the Geotechnical Engineer. Structural Fill is according to Division 31 Section "Earthwork," as required in addition to that required in the Scope of Work.
2. Unit of Measurement: Cubic Yard (CY) in final place of fill imported, placed and compacted (“Bank yards) as measured by on site Geotechnical inspector.
3. Unit Price No. UP-2 shall be applied to Unit Price Allowance UPA-2.

E. Unit Price No. UP-3: Additional Earthwork Imported CDF:

1. Amount: To be the Extended Price as listed on the Contractor’s Bid Form for this Unit Price.
2. Contractor shall include in the Base Bid amount an allowance for unanticipated imported CDF that is beyond the scope defined in the contract documents and shall be delivered to the site, placed and compacted in place in a manner defined in the specification and as directed by the geotechnical Engineer.
3. Unit of Measurement: Cubic Yard (CY) in final place of fill imported, placed and compacted (“Bank yards) as measured by on site Geotechnical inspector.
4. The value of Allowance UPA-3 shall be calculated by multiplying the value of Unit Price UP-3 by the quantity of 50 cubic yards as listed on the bid form.

END OF SECTION 012200

dj: October 5, 2017
ss/November 6, 2017
cj: January 2, 2018

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

A. Definition: An Alternate is an amount proposed by bidders and stated on the Bid Proposal form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each Alternate is the net addition to, or deduction from, the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

1. Include as part of each Alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

B. Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each Alternate. Indicate whether Alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to Alternates.

C. Execute accepted Alternates under the same conditions as other Work of this Contract.

D. Schedule: A non-Technical Description “Schedule of Alternates” is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each Alternate.

PART 2 - PRODUCTS

2.1 GENERAL

A. The applicable Sections of the Specifications, and requirements noted on the drawings, apply to the Work under each Alternate item.

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1A – Provide Controls System by Andover

1. Description: Provide integrated automation building controls per specification Division 25 from Andover Continuum Building Automation.

B. Alternate No. 1B –Provide Controls System by Johnson Controls.

1. Description: Provide integrated automation building controls per specification Division 25 from Johnson Controls

C. Alternate No. 2 – Add DAS System

1. Description: Add a Distributed Antenna (DAS) Emergency Responder System per specification Division 26

D. Alternate No. 3 – Add Lane Widening

1. Description: Add lane widening as shown in the project drawings and per specification Division 32

E. Alternate No. 4 – Pave Employee Parking Lot

1. Description: Add paving of employee parking lot as shown in the project drawings and per specification Division 32.

END OF SECTION 012300

SECTION 012500 - PRODUCT SUBSTITUTIONS & OPTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Furnish and install products in accordance with options and conditions for substitutions stated in this Section.

1. Where specified only by performance or reference standards, select a product meeting standards by any Manufacturer.
2. Where specified by naming several products or Manufacturers, select any product and Manufacturer named.
3. Where specified by naming one or more products, but indicating "or approved" or similar wording after specified listing, select specified product or submit Request for Product Substitution on attached form.
4. Where specified by naming only one product and Manufacturer, there is no option, and no substitution will be allowed.

B. Substitutions

1. Prior to Bid Date, submit Request for Product Substitution to Architect:

    a. Two (2) copies of each form if submitted in hard copy
    b. Electronic submittals are preferred.
    c. Submit seven (7) days minimum prior to scheduled Bid Date.
    d. Accepted substitutions will be acknowledged by Addenda.

2. After Contract date the Owner may, at their option, consider certain other substitutions submitted in accordance with requirements of this Section. Indicate one or more of the following reasons for request.

    a. Substitution is required for compliance with final code interpretation requirements, or insurance regulation.
    b. Specified product is unavailable through no fault of Contractor.
    c. Subsequent information discloses specified product unable to perform properly or fit designated space.
    d. Manufacturer or fabricator refuses to certify or guarantee performance of specified product, as required.
    e. Substitution saves substantial cost, time. (Submit accurate cost and/or time data for proposed substitution in lieu of product specified.)

3. In making request for Substitution, Manufacturer/Contractor represents:

    a. It has personally investigated proposed product and, in his opinion, it is equal or superior in all respects to that specified.

        1) Substantiate whenever requested by Architect.

    b. It will coordinate installation of accepted substitution into the Work and guarantees to complete it in all respects.

        1) It has identified any and all changes, if any, required to other portions of the Work as a result of the proposed product.

    c. It will provide the same or an improved guarantee for the proposed substitution as for the specified product.
    d. It waives all claims for additional costs related to the proposed substitution that consequently become apparent.
    e. It agrees to pay all of the Owner's additional costs related to the proposed substitution that consequently become apparent, such as redesign expenses, utility and service relocations, etc.
    f. Cost data is complete and includes all related costs under its Contract, but excludes:

4. Cost under separate Contractors. (Show impact on attached Form).
5. Design Consultants' redesign, unless designated.
6. Substitutions will not be considered if:

    a. They are indicated or implied on Shop Drawings or other submittals without proper submittal on attached Form.
    b. Acceptance will require substantial revisions of Contract Documents.

7. Contractor shall pay Architect and his Consultants for time required to review substitutions, if requested.
8. Architect is sole judge of suitability of substitution and decision is final.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012500

NAC
ARCHITECTURE

Substitution Request Form

To*	NAC Architecture	**Project**	WSH New Kitchen Commissary Pharmacy
		Date	
		NAC No.	121 - 16004 - 09C

* Please send Mechanical and Electrical requests directly to the Consultant.

1. We hereby submit for your consideration a substitution for the following specified item for the above project.

   Item currently specified (Use Alt + Enter to create new lines.)

Spec Section	Page	Line/Paragraph

2. Proposed Substitution (Use Alt + Enter to create new lines.)

3. Reason for Substitution (Use Alt + Enter to create new lines.)

4. Attach complete technical data, catalog cuts, Drawings, samples, etc. Exact models and description of products shall be noted with any deviation noted.

5. Include complete information on changes to Drawings, and/or Specifications which proposed substitution will require for its proper installation.

6. ☐ The substitute affects dimensions shown on Drawings (affirmative indicated by a check mark).

6a. If so (checked), how?

7. ☐ The substitute adds cost to the Owner (affirmative indicated by a check mark).

7a. If so (checked), approximately how much?

8. Describe the effect substitution has on other trades.

9. Describe differences between proposed substitution and specified item.

10. Manufacturer's warranties of the proposed and specified items are ◉ Same ○ Different (explain on attachment)

>1203 West Riverside Avenue, Spokane, WA 99201-1107
509 838 8240 / nacarchitecture.com
Seattle / Spokane / Los Angeles

012501-COMMENT SubstitutionRequestForm.xlsm

Substitution Request Form

Submitted By

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item. The undersigned agrees to pay for changes to the building and systems design, including engineering and detailing costs caused by the requested substitution.

Signature

Company

Address

City State ZIP

Phone Fax Email

☐ Please check if there are attachments

For Reviewer

☐ Approved for Bidding subject to review and approval of Submittals (and as noted below)

☐ Rejected - Inadequate Information

☐ Not Accepted

☐ Received Too Late

By Date

Remarks

(Use Alt + Enter to create new lines.)

>1203 West Riverside Avenue, Spokane, WA 99201-1107
509 838 8240 / nacarchitecture.com
Seattle / Spokane / Los Angeles

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 GENERAL

A. Changes to and/or clarifications of the Work may be initiated by a Request for Information (RFI), Architect's Supplemental Instruction (ASI), Construction Field Authorization (FA), or a Change Order Proposal (COP).

B. A monetary change to the Contract Sum is only implemented by a Change Order (CO).

1.3 DOCUMENTATION OF COSTS

A. Unit prices noted on the Bid Form shall include all overhead, profit and related costs. Adjustments shall be made in accordance with General Conditions. The Contractor shall document quantities used.

B. All actual or proposed costs, whether initiated by a Change Order Proposal or Construction Field Authorization, shall be summarized on forms provided by Owner, with all necessary substantiating documentation attached thereto.

C. The Owner reserves the right to request notarized time sheets, invoices and other documentation as necessary to protect the public interest.

1.4 CHANGES TO CONTRACT TIME

A. The Contractor shall make every effort to comply with the Contract Dates of Substantial and Final Completion.

B. The Contractor may not make claim for costs or losses associated with the use of float time, if any, between anticipated completion dates and the Contract Dates of Substantial and Final Completion.

C. Only impacts on critical path activities which can be documented as delaying the Contract Date of Substantial Completion shall be considered for changes to the Contract Time.

1.5 REQUEST FOR INFORMATION (RFI)

A. Prepared by Contractor and distributed to Owner and Architect.

B. Form provided by Owner or Architect.

C. Response provided by Architect.

D. Distributed by Architect following Owner's acceptance.

E. Contractor must either:

1. Proceed upon receipt of response if no cost impact, or,
2. Submit a statement of cost impact within 7 days of receipt of response.

a. If cost impact is justified, Architect shall issue a FA and/or COP.
b. If cost impact is not justified, Architect will issue a Notice to Proceed, directing the Contractor to proceed with the Work in question, with no change to the Contract Sum.

F. RFIs and responses to RFIs shall be numbered consecutively. RFIs reissued for additional clarification or information shall be given decimal extensions (e.g. 12.1).

G. Responses shall be recorded weekly on record drawings and specifications.

1.6 ARCHITECT'S SUPPLEMENTAL INSTRUCTION (ASI)

A. Prepared by Architect.

B. Form provided by Owner or Architect.

C. No change in time or cost as determined by Architect.

D. Acceptance by owner required prior to issuance to Contractor.

E. Transmitted to Contractor for signature.

F. Contractor must either:

1. Proceed upon receipt.
2. Submit a statement of cost impact within 7 days of receipt.

a. If cost impact is justified, Architect shall issue a FA and/or COP.
b. If cost impact is not justified, Architect will issue a Notice to Proceed, directing the Contractor to proceed with the work in question, with no change to the Contract sum.

G. Architect's Supplemental Instructions shall be numbered consecutively. Reissued ASI's shall be given decimal extensions (e.g. 17.1).

H. Changes shall be recorded weekly on record drawings and specifications.

1.7 CHANGE ORDER PROPOSAL (COP)

A. Issued by Architect and distributed to Contractor and Owner.

B. May be initiated by Contractor by submitting a written notice to Architect indicating justification and proposed cost impact.

C. Contractor must provide cost data and substantiating documentation within 14 days of receipt of COP.

D. All costs must be summarized on the forms provided by the Owner, utilizing the fees indicated.

E. Direct costs of labor and fringe benefits shall be limited to the amounts shown in Statements of Intent to pay Prevailing Wages. Additional labor burden costs shall be limited to actual costs substantiated in writing by the Contractor and approved by the Owner and Architect.

1. All indirect costs, including but not limited to such items as insurance, taxes, (except Sales Tax), general conditions, small tool allowance, plant and equipment costs, and the like, shall be included in the fees as provided for on the forms, which shall not exceed the percentages specified in the General and/or Supplemental Conditions.

F. Architect makes recommendation.

G. Owner accepts or rejects:

1. Owner/Architect prepares Change Order, or,
2. Owner/Architect requests additional cost data, and/or issues FA.
3. Owner may issue Notice to Proceed to expedite Work.

H. Accepted and signed COP is binding on both Owner and Contractor. It is the Notice to Proceed and authorization to do the work as soon as practical.

I. COPs shall be numbered consecutively. Reissued COPs shall be given decimal extensions.

J. Changes shall be recorded on record drawings and specifications.

K. COPs and FAs cannot be invoiced until incorporated into an approved Change Order.

1.8 CONSTRUCTION FIELD AUTHORIZATION (FA)

A. Issued by Architect in response to:

1. An unresolved Architect's Supplemental Instruction.
2. The absence of agreement on Change Order Proposal costs submitted by Contractor.
3. The need to expedite the work and avoid delays.

B. Form provided by Owner or Architect.

C. Signed by Architect and Owner.

D. Contractor must proceed immediately with the work identified in the FA.

E. Method of adjustment of the Contact Sum shall be determined per General and/or Supplemental Conditions.

F. FAs cannot be invoiced until incorporated into an approved Change Order.

1.9 CHANGE ORDER (CO)

A. Prepared by the Owner.

B. May include several COPs and/or FAs.

C. Shall be signed by Contractor as soon as practicable.

D. Change Orders shall be numbered consecutively.

E. Changes shall be marked on record drawings and specifications.

F. Costs May be included in Applications for Payment only following approval of the Change Order by the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012600

dj: October 5, 2017
ss/November 1, 2017

Washington State Department of Enterprise Services
FACILITIES DIVISION
ENGINEERING & ARCHITECTURAL SERVICES (E&AS)

CONTRACT CHANGE ORDER PROPOSAL (COP)

DSHS
AGENCY

CONTRACT NO. 2016-410G (2-1

WSH New Kitchen Commissary Pharmacy
PROJECT TITLE

COP No. _____

PROPOSAL REQUEST

TO: _____ **(CONTRACTOR)** **PROPOSAL REQUEST DATE:** _____

You are directed to prepare a cost proposal for the work described below and/or detailed on the attachments referred to:

REASON FOR CHANGE: ○ DESIGN ERRORS ○ DESIGN OMMISSIONS ○ AGENCY ○ LATENT CONDITIONS ○ CODE REQUIREMENTS ○ VALUE ENGINEERING

EXPLANATION: _____

DATE PROPOSAL REQUIRED: _____ CHANGE ORIGINATED BY: _____
(14 days from Request Date, unless other date agreed to)

PROPOSAL REQUESTED BY: _____

CONTRACTOR PROPOSAL

TO: _____ (A/E) TO: _____ PM (E&AS)

WE AGREE TO PERFORM ALL CHANGE IN THE WORK DESCRIBED IN THE PROPOSAL REQUEST FOR:

CONTRACT SUM:

☐ NO CHANGE
☐ INCREASE
☐ DECREASE

} OF _____ **$** _____
(WASHINGTON STATE SALES TAX NOT INCLUDED)

In accordance with the General Conditions, Cost Estimate Detail Sheet(s) are attached hereto.

CONTRACT TIME:

☐ NO CHANGE
☐ INCREASE
☐ DECREASE

} OF _____ CALENDAR DAYS

The foregoing amount covers everything required in connection with the change. All other provisions of the contract remain in full force and effect.

We understand that this proposal does not constitute authorization to proceed with the specified changes in the work until incorporation of this COP into a Change Order by the Department of Enterprise Services.

_____ BY _____ _____
CONTRACTOR SIGNATURE DATE

RECOMMENDATION

TO: The Department of Enterprise Services' Authorizing Signator

We have carefully examined this proposal and find the cost to be reasonable. Therefore, we recommend acceptance.

A/E	DATE	E&AS COST VERIFICATION	DATE
AGENCY	DATE	E&AS PROJECT MANAGER	DATE

Washington State Department of Enterprise Services
FACILITIES DIVISION
ENGINEERING & ARCHITECTURAL SERVICES (E&AS)

CONSTRUCTION FIELD AUTHORIZATION (FA)

DSHS
AGENCY

CONTRACT NO. 2016-410G (2-1)

WSH New Kitchen Commissary Pharmacy
PROJECT TITLE

FA No. _____

TO: _____ **(CONTRACTOR)** **REQUEST DATE:** _____

When authorized by E&AS, you are directed to proceed with work as described below and/or detailed on the attachments referred hereto:

DESCRIPTION OF CHANGE IN THE WORK

REASON FOR CHANGE: ◉ DESIGN ERRORS ○ DESIGN OMISSIONS ○ AGENCY ○ LATENT CONDITIONS ○ CODE REQUIREMENTS ○ VALUE ENGINEERING

EXPLANATION: _____

CHANGE ORIGINATED BY _____ NAME _____ COMPANY

PROPOSED MAXIMUM SUM/TIME

CONTRACT SUM:

☐ NO CHANGE
☐ INCREASE
☐ DECREASE

TO THE CONTRACT SUM WITHIN THE PROPOSED MAXIMUM COST OF:

_____ DOLLARS **$** _____

The above amount covers the maximum amount required in connection with the change. Washington State sales tax not included.

CONTRACT TIME:

☐ NO CHANGE
☐ INCREASE
☐ DECREASE

OF: _____ CALENDAR DAYS

COST DATA COLLECTION

Cost data required by one of the following methods in accordance with the General and Supplemental Conditions.

☐ DETAILED COST BREAKDOWN
☐ UNIT PRICE
☐ ACTUAL PRICE

_____ METHOD OF MEASUREMENT

Time & Material with daily work sheets that list the name, trade, firm, hours, itemized materials, equipment and other job related costs. Contractor must obtain verification of hours from _____ (Owner's Rep)

within _____ days from the day work was performed. Cost data required by: _____ (Date)

DIRECTION TO PROCEED

Contractor agrees to perform the work described above for the proposed maximum cost and time as shown above. Contractor agrees to give notice to Owner Immediately if time or cost will be exceeded.

ACCEPTED BY CONTRACTOR _____ DATE

Proposal reviewed & proposed maximum cost is reasonable.

APPROVED BY A/E _____ DATE

FUNDING VERIFICATION BY AGENCY _____ DATE

AUTHORIZED BY E&AS _____ DATE

Payment for work authorized by this FA will not be made prior to incorporation of this FA into a Change Order to the contract by the Department of Enterprise Services.

FINAL APPROVAL

$ _____ FINAL COST

CONTRACTOR _____ DATE

Final cost breakdown has been reviewed and final cost is accepted.

A/E _____ DATE

AGENCY _____ DATE

E&AS _____ DATE

COST VERIFICATION

E&AS _____ DATE

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Schedule of Values and Applications for Payment.

B. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule.

1.3 APPLICATIONS FOR PAYMENT

A. Submit itemized Applications for Payment as required in General Conditions together with Schedule of Values and other submittals as listed herein.

B. Except as otherwise indicated, sequence of progress payments is to be regular, once per month; and each must be consistent with previous Applications and payments. It is recognized that certain Applications, including the Initial Application, the Application following Substantial Completion, and the Final Application for Payment include additional requirements specific to that Application.

C. The Contractor shall certify that to the best of its knowledge, information, and belief, the work covered by each Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by him for work for which previous Applications for Payment were issued and that all computations, attachments, invoices and representations are truthful and accurate.

D. Except as otherwise indicated, the Contractor shall complete every entry provided for on the various forms, and execution by authorized persons. Incomplete applications shall be returned by the Architect without action

1. Entries must match current data in the Schedule of Values and the Construction Progress Schedule.

E. Payment-Application Times: The period covered by each Application shall be one calendar month.

F. Payment-Application Forms: Use the State of Washington Application for Payment on Contract form.

1. http://www.des.wa.gov/services/facilities-leasing/public-works-design-construction/formsreference-documents

G. Application Preparation: Complete every entry on the form. The Architect will return incomplete applications without action. Responsibility for delay of payment due to incomplete, inaccurate or incorrect forms shall be the Contractor's.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Field Authorizations issued prior to the last day of the construction period covered by the application. Show such amounts separately from other work already included in the Schedule of Values.

H. Diversity Participation Reporting: Submit the following payment information per the Instructions to Bidders through https://des.diversitycompliance.com.

1. Payments received by the prime contractor from the Agency.
2. Payments paid to each subcontractor, including lower tier subcontractors.
3. Payments paid to each supplier.

I. Transmittal: Submit 4 signed original copies of each Application for Payment to the Architect and Owner by a method ensuring receipt within 24 hours. All applications shall be complete, including waivers of lien and similar attachments. Applications may be submitted in electronic format if approved by the Owner.

1. Transmit each application with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

J. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following. Failure to submit any of the following is sufficient grounds to withhold processing of Application for Payment.

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Approved Schedule of Values.
4. Approved Contractor's Construction Schedule.
5. Schedule of principal products and submittals.
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of any building permits, authorizations and licenses to be obtained by the Contractor from governing authorities for performance of the Work.
9. Certificates of insurance and insurance policies not previously required or filed.
10. Proof of submission of Intent to Pay Prevailing Wage documentation must be submitted to the Owner prior to the first payment application, and every subsequent application, in which a subcontractor is being paid for the first time.

K. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Occupancy issued previously for Owner occupancy of designated portions of the Work.
2. Administrative actions and submittals that must be submitted to the Owner through the Architect prior to the time of Application for Payment at Substantial Completion are set forth below. See also the requirements of Division 01 Section "Closeout Procedures."

    a. Signed and itemized receipt that maintenance and other personnel instruction and classes have been presented including signed receipt for each instructional session from Owner's representative. List date; length of time; names of Owner's personnel in attendance and location.
    b. Removal of temporary facilities and services no longer required by the work.

L. Final Payment Application: Administrative actions and submittals that must be submitted to the Owner through the Architect prior to the time of Application for Payment at Final Completion are set forth below. See also the requirements of Division 01 Sections.

1. Ensure that unsettled claims have been settled.
2. Signed receipt of transmittal of required Project construction records to the Owner.
3. Removal of temporary facilities and services, if not previously accomplished.
4. Removal of surplus materials, rubbish, and similar elements.
5. Project Permit Drawings and related documents including copies of the signed off permit sheets.
6. All final submittals shall be submitted at the same time. Partial submittals will not be processed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012900

dj: November 21, 2017
ss/November 1, 2017

SECTION 012973 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 GENERAL

A. Within ten (10) days after Award of Contract, submit Schedule of Values to Owner and Architect.

1. Coordinate and integrate with CPM schedule.
2. Support values if requested by Architect.
3. Use Schedule of Values as basis for Application for Payment.

B. Coordinate related requirements specified in other parts of the Project Manual.

1.3 FORM

A. Submit the Schedule of Values on the State of Washington invoice Voucher Form A-19, listing not less than one item for all pertinent activities applicable to each Section of the Project Manual, and relating directly to the pertinent application activities of the CPM Schedule.

B. Identify each item with number and title of respective major Specification Sections.

C. Correlate line items with other administrative schedules and forms required for the work, including CPM progress schedule, payment request forms, listing of subcontractors, Schedule of Allowances, listing of products and principal suppliers and fabricators, and Schedule of Submittals.

D. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment request and progress reports. Each line item shall have a separate categories to indicate the cost for materials, labor and closeout.

E. No line item shall exceed $250,000. Labor and/or materials for a portion of the Work in excess of this amount shall be subdivided into smaller, easily identifiable items of work.

F. Break down principal subcontract amounts into multiple line items.

G. Upon request of the Architect, submit further breakdown of the work in any of the Sections of the Project Manual.

H. Change Orders and their approved sums are to be listed as separate items.

I. Listings: Arrange schedule with columns to indicate the following:

1. Item number: Use sequential numbering system.
2. Specification Section: Indicate Specification Section, using decimal extensions, as required, if more than one subcontractor, supplier, etc., is involved, or if Work is broken down by phase or area (e.g. wall framing, roof framing, etc.).
3. Description of Work: For each line item of work involving labor and materials, provide individual sub-line items for (a) Material, (b) Installation/Labor and (c) Closeout.: All line items, whether or not involving installation/labor shall include a sub-line item for Closeout.
4. Total dollar value of each line item.
5. Percentage of Contract Sum (total shall add up to 100%).

1.4 CONTENT

A. Include separate line item values (or multiple line items where applicable) for:

1. General Contractor's overhead and profit for entire project.
2. General Contractor's project management and supervision.
3. Project closeout per General Conditions.
4. Allowances.
5. Construction Surveying.
6. CPM Schedule.
7. Mobilization per General Conditions.
8. Bond.
9. Insurance.
10. Security Fencing.
11. Site Clearing.
12. Site Grading.
13. Site utilities (separate line items for each utility type).
14. Building Envelope Completion (dry-in complete).
15. Air Barrier and Envelope Testing.
16. Permanent Electrical Power.
17. Mechanical Equipment Start Up.
18. Commissioning Pre-Functional Checklist.
19. Assist Commissioning – Mechanical.
20. Assist Commissioning – Electrical.
21. Owner Training – General.
22. Owner Training – Equipment (Kitchen, Commissary, etc.)
23. Owner Training – Mechanical.
24. Owner Training – Electrical.
25. Final Cleaning.
26. Site Cleanup.
27. Project Record Plans & Specification.
28. Operations and Maintenance Manuals.
29. Landscape Maintenance.
30. Technology Cabling.

1.5 SCHEDULE UPDATING

A. Update and resubmit Schedule of Values when Change Orders affect listing and when actual performance of the work involves necessary changes of substance to values previously listed.

1.6 SUBMITTAL

A. Submit electronic copies of Schedule to Architect and Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012973

SECTION 013113 – PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK

A. Minimum administrative and supervisory requirements necessary for coordination of work on the project include but are not necessarily limited to the following categories:

1. Coordination and meetings.
2. Health Department inspections.
3. Administrative and supervisory personnel.
4. Surveys and records or reports.
5. Limitations for use of site.
6. Special reports.
7. General installation provisions.
8. Cleaning and protection.
9. Conservation and salvage.
10. Cultural resources.
11. Construction waste and indoor air quality management.

B. In addition, the Contractor will be responsible to carry out the execution of the commissioning process in conjunction with the Commissioning Agent.

1.3 COORDINATION AND MEETINGS

A. General: Prepare a written memorandum on required coordination activities. Include such items as required notices, reports and attendance at meetings. Distribute this memorandum to each entity performing work at the project site. Prepare similar memorandum for separate contractors where interfacing of their work is required.

B. Weekly Coordination Meetings: Hold weekly Contractor's Coordination Meetings at regularly scheduled times convenient for all parties involved. Request representation at each meeting by every subcontractor/supplier currently involved in ongoing Work, or involved in the coordination or planning of the entire project.

C. Coordination of Additional Project Information: The Contractor shall be responsible for timely distribution to all affected subcontractors and suppliers of supplemental information developed or provided during the course of construction. To the extent possible, requests for additional information from the Architect or Owner should be addressed at the weekly coordination meetings, with responses recorded in the meeting minutes. When not possible, a Request for Information (RFI) form shall be submitted by the Contractor to the Architect.

D. Coordination of Commissioning Activities: Coordinate and execute Commissioning per other Specification Sections and related requirements.

1.4 HEALTH DEPARTMENT INSPECTIONS

A. General: The Washington State Department of Health (DOH) requires the following on-site inspections:

1. Prior to the placement of the gypsum wall board.
2. Prior to placement of ceiling tiles.
3. Two weeks prior to final inspection by the local building official.

B. Notify the DOH at least one week prior to these inspections.

1.5 ADMINISTRATIVE/SUPERVISORY PERSONNEL

A. General: In addition to the required General Superintendent, provide additional administrative and supervisory personnel required for performance and coordination of the work.

B. Project Coordinator: Provide a Project Coordinator experienced in administration and supervision of building construction, including mechanical and electrical work. This Project Coordinator is hereby authorized to act as general coordinator of interfaces between units of work. For the purpose of this provision, "interface" is defined to include scheduling and sequencing of work, sharing of access to work spaces, installations, protection of each other's work, cutting and patching, tolerances, cleaning, selections for compatibility, preparation of coordination drawings, inspections, tests, and temporary facilities and services.

C. Contractor’s Commissioning Coordinator (CCC): The Contractor shall provide a qualified Contractor’s Commissioning Coordinator who meets the requirements set forth in Section 019113 - General Commissioning Requirements, with responsibilities as defined therein. Commissioning procedures will be designed and conducted by a Commissioning Agent (CA) contracted by the Owner.

D. Testing, Adjusting and Balance Contractor (TAB): The Contractor shall provide the services of a qualified TAB contractor. The qualifications of the TAB contracting firm shall be submitted, along with the specific qualifications of the lead site technician who will remain on site during all TAB work, within 30 days of notice to proceed. Recent past projects shall be listed and described for both the company and the lead technician. Names and telephone numbers of the project contractors and facility managers will be provided.

1. The Owner must approve in writing the qualifications of both the company and the lead technician.

E. Submittal of Staff Names, Duties: Within 15 days of Notice to Proceed, submit a listing of Contractor's principal staff assignments and consultants, naming persons and listing their addresses and telephone numbers.

1.6 SURVEYS AND RECORDS/REPORTS

A. General: Working from lines and levels indicated on the drawings, establish and maintain bench marks and markers to set lines and levels for the work at each story of construction and elsewhere as needed to properly locate each element of the project. Calculate and measure required dimensions as shown within recognized tolerances. Drawings shall not be scaled to determine dimensions. Advise entities performing work, of marked lines and levels provided for their use.

B. Surveyor: Engage a licensed, Professional Land Surveyor or Professional Engineer experienced and specializing in land survey work, who is registered in the State of Washington, to perform those services specified in this article.

C. Survey Procedures: Before proceeding with the layout of actual work, verify the layout information shown on the drawings, in relation to the property survey and existing benchmarks. As work proceeds, check every major element for line, level and plumb. Maintain a surveyor's log or record book of such checks; make this log or record book available for the Architect's or Engineer's reference. Record deviations from required lines and levels, and advise the Architect or Engineer promptly upon detection of deviations that exceed indicated or recognized tolerances. Record deviations which are accepted, and not corrected, on record drawings.

1.7 LIMITATIONS ON USE OF THE SITE

A. General: Administer allocation of available space equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

1.8 SPECIAL REPORTS

A. General: Submit special reports directly to the Owner within one day of an occurrence. Submit a copy of the report to the Architect/Engineer and other entities that are affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at the site, prepare and submit a special report listing chain of events, persons participating, response by the Contractor's personnel, an evaluation of the results or effects and similar pertinent information. Advise the Owner in advance when such events are known or predictable.

C. Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.9 CONSTRUCTION WASTE AND INDOOR AIR QUALITY MANAGEMENT

A. LEED requirements need ongoing coordination and reporting to ensure subcontractor participation. Contractor shall either conduct separate construction waste and indoor air quality management meetings or discuss goals and issues as part of the following regular meetings.

1. Pre-construction and pre-installation meetings.
2. Weekly subcontractor meetings.
3. Conduct Special Construction Waste and Indoor Air Quality Management meetings once building weather enclosure is complete.

1.10 CULTURAL RESOURCES

A. The Contractor shall coordinate with the Owner's selected Archeologist once initial vegetation has been removed to allow for further assessment of the site.

1.11 CONSTRUCTION WASTE AND INDOOR AIR QUALITY MANAGEMENT

A. LEED requirements need ongoing coordination and reporting to ensure subcontractor participation. Contractor shall either conduct separate construction waste and indoor air quality management meetings or discuss goals and issues as part of the following regular meetings:

1. Pre-bid meeting.
2. Pre-construction meeting.
3. Pre-fabrication meeting.
4. Regular job-site meetings.
5. Job safety meetings.
6. Special Construction Waste and Indoor Air Quality Management meetings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Pre-Installation Meetings: Hold a pre-installation meeting at the project site well before installation of each unit of work which requires coordination with other work. Installer and representatives of the manufacturers and fabricators who are involved in or affected by that unit of work, and with its coordination or integration with other work that has preceded or will follow shall attend this meeting. Advise the Owner/Architect/Engineer of scheduled meeting dates.

1. Do not proceed with the work if the pre-installation meeting cannot be concluded successfully. Initiate whatever actions are necessary to resolve impediments to performance of the work, and reconvene pre-installation meeting at earliest date feasible.

B. Installer's Inspection of Conditions: Require the Installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The Installer shall report all unsatisfactory conditions in writing to the Contractor, prior to the Pre-Installation Meeting. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

C. Manufacturer's Instructions: Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the contract documents.

D. Inspect each item of materials or equipment immediately prior to installation. Reject damaged and defective items.

E. Provide attachment and connection devices and methods for securing work. Secure work true to line and level, and within recognized industry tolerances. Allow expansion and movement. Provide uniform joint width in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable visual-effect choices to the Architect for final decision.

F. Recheck measurements and dimensions of the work, as an integral step of starting each installation.

G. Install each unit-of-work during weather conditions and project status which will ensure the best possible results in coordination with the entire work. Isolate each unit of work from incompatible work, as necessary to prevent deterioration.

H. Coordinate enclosure or covering of the work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry-recognized standard (including ADA) mounting heights for the particular applications indicated. Refer questionable mounting height choices to the Architect for final decision.

3.2 CLEANING AND PROTECTION

A. General: During handling and installation of work at the project site, clean and protect work in progress and adjoining work on a basis of continuous maintenance. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of substantial completion.

B. Clean and perform maintenance on installed work as frequently as necessarily through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures of Work: To the extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to

harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.3 CONSERVATION AND SALVAGE

A. General: It is a requirement for supervision and administration of the work that construction operations be carried out with the maximum possible consideration given to conservation of energy, water and materials and to the recycling of excess and waste materials. In addition maximum consideration shall be given to salvaging materials and equipment involved in performance of the work but not incorporated therein.

END OF SECTION 013113

ss\November 9, 2017

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including but not limited to, the following:

1. Preconstruction meeting.
2. Weekly construction progress meetings.
3. Contractor's coordination meetings.
4. Pre-installation meetings.
5. Commissioning Meetings.

1.3 PRECONSTRUCTION MEETING

A. Preconstruction Meeting: A meeting shall be scheduled by the Architect following Award of Contract. Administrative requirements such as Schedule of Values, Contractor's Quality Control Plan, Applications for Payments, progress schedules, Change Order procedures, Substantial Completion, Project Closeout, and Final Completion shall be addressed as well as other items on the standard DES Preconstruction meeting agenda form.

B. Agenda: Architect shall prepare agenda.

C. Discussion will cover items of significance including but not limited to the following:

1. Communication chain and persons authorized to direct changes;
2. The Work;
3. Owner's Site Representatives roles;
4. Work hours, sequence, phasing and occupancy;
5. Procedures and processing;

a. Applications for Payments;
b. Change Order Proposals (COPs);
c. Field Authorizations (FAs);
d. Change Orders (COs);
e. Requests for Information (RFIs);
f. Architect's Supplemental Instructions (ASIs);
g. Submittals and Submittal Transmittal Forms;
h. Others as appropriate.

6. Project Record Documents (Drawings and Specifications) review on a regular basis;

7. Construction facilities and controls;
8. Temporary utilities;
9. Security procedures;
10. Housekeeping procedures;
11. Parking and Deliveries;
12. Project Schedule;
13. Contractor's Quality Control Plan (CQC);

    a. CQC Administrator.
    b. CQC Daily Reports.
    c. CQC pre-installation and installation conditions documentation; and
    d. CQC pre-installation meetings.

14. Use of site and premises by Owner and Contractor;
15. Emergency phone numbers;
16. Others as appropriate.

D. Record: Meeting minutes shall be taken by the Architect and shall stand as recorded unless objected to in writing by the Contractor within five (5) days of receipt.

E. Attendees:

1. Testing Lab Representative.
2. Soils Engineer.
3. Owner.
4. Architect and major subconsultants.
5. Contractor's Project Manager, Superintendent, and major Subcontractors including: Earthwork, Utilities, Mechanical, Electrical, and as applicable.

1.4 CONSTRUCTION PROGRESS MEETINGS

A. The Contractor will schedule weekly meetings at Contractor's job site field office to enable an orderly review of the construction progress and to provide for systematic discussion and analysis of concerns that may arise relative to execution of the Work.

B. Attendees:

1. Architect and Architect's Consultants, as appropriate;
2. Owner's representatives;
3. Contractor's superintendent, project manager and CQC Plan Administrator;
4. Subcontractors, as appropriate;
5. Suppliers, as appropriate; and
6. Others, as appropriate.

C. Agenda: The following items will be discussed:

1. Review and approve minutes of previous minutes;
2. Review work progress since previous meetings (3-week short-term schedule);
3. Review work scheduled for next two weeks (3-week short-term schedule);

4. Review CPM schedule to confirm current status of Work, including material delivery status;
5. Review Safety program and report any incidents.
6. Review Contractor's Quality Control records;
7. Review the status of the following procedural processes and documents as required/appropriate/necessary/needed;

    a. Applications for Payments.
    b. Diversity compliance reporting on des.diversitycompliance.com.
    c. Change Order Proposals (COPs).
    d. Field Authorizations (FAs).
    e. Change Orders (COs).
    f. Requests for Information (RFIs).
    g. Architect's Supplemental Instructions (ASI).
    h. Submittals.
    i. Construction waste management update
    j. LEED requirements and reporting
    k. Commissioning update
    l. As-Built document updates.

8. Present, discuss and, when possible, resolve field observation problems, conflicts, risks and concerns.

    a. Civil/Landscape items.
    b. Structural items.
    c. Controls items.
    d. Mechanical items.
    e. Electrical items.
    f. Architectural/Miscellaneous items.

9. Coordination of separate contracts.
10. Other business as required.

D. Record: Meeting minutes shall be taken by Architect, and shall be reviewed at the following Meeting, subject to comments/corrections noted and incorporated into the Minutes of said Meeting.

E. Monthly: Monthly tasks shall include:

1. Update and coordination of submittal and change logs.
2. Review of Application for Payment.
3. Review of updated CPM schedule.

1.5 CONTRACTOR'S COORDINATION MEETINGS

A. Contractor shall hold weekly coordination meetings with his subcontractors and suppliers for coordination of the Work. Meetings shall be held on-site.

B. Contractor's Coordination Meetings are in addition to meetings held for other purposes such as weekly Construction Progress Meetings or CQC Pre-installation Meetings.

C. Contractor shall record minutes of meetings and distribute copies to Owner and Architect, and to others affected by decisions or actions resulting from each meeting, within two days of the meeting.

1.6 CQC PRE-INSTALLATION MEETINGS

A. General: Not less than seven (7) days prior to commencement of work listed below or as otherwise determined by the Architect or the Owner, the General Contractor or his superintendent, the responsible foremen for the subcontractors performing said Work, plus all associated sub-subcontractors, suppliers, fabricators, vendors, and others as appropriate, including the Owner and Architect, shall attend a meeting for the purpose of establishing a full understanding of the procedures and requirements for the orderly progress of the designated Work.

B. All subcontractors and major suppliers are required to attend these pre-installation meetings prior to commencing work on their respective Specification Sections. Contractor may elect to group several Sections or Divisions to minimize the number of these meetings. Refer to Specification Sections "Project Coordination" and "Quality Requirements" for additional requirements pertaining to project coordination and quality requirements, respectively.

C. Contractor shall schedule meetings and notify Architect and Owner not less than seven (7) days prior to the date of the meetings. All applicable submittals as well as the Contractor's safety plan and insurance certificates shall have been submitted to and approved by the Owner prior to the scheduling of any meetings. Work requiring pre-installation meetings includes, but is not necessarily limited to the following:

1. Earthwork,
2. Landscaping and Irrigation,
3. Site Improvements,
4. Concrete – Architectural precast and architectural finishing,
5. Masonry,
6. Structural Steel,
7. Commissioning – Building envelope, mechanical and electrical systems,
8. Roofing/Sheet Metal,
9. Windows/Storefronts/Curtain Walls/Glazing,
10. Gypsum Board Assemblies,
11. Floor Finishes – Carpet/resilient/wood/polished concrete,
12. Painting,
13. Controls – HVAC and Lighting,
14. Testing, Adjusting and Balancing,
15. Fire Suppression System,
16. Fire Alarm System,
17. Audio/Visual Systems,
18. Telecommunications Cabling,
19. Intrusion Detection and.or Access Control Systems,
20. Distributed Antenna System, if any.

21. Elevator.
22. Food Service Equipment.
23. All work on the critical path and/or otherwise deemed necessary or appropriate.

D. Contractor shall record minutes of meeting and distribute copies to Owner and Architect, and to others affected by decisions or actions resulting from each meeting, within seven (7) days of date of Meeting.

1.7 COMMISSIONING MEETINGS

A. Refer to Division 01 Section "Commissioning General Requirements" and individual Specification Sections, for attendance, scheduling, and agenda requirements and responsibilities.

1.8 CLOSEOUT MEETING

A. At the point when the construction is approximately 75 percent complete, the Contractor shall request and schedule a meeting to review project closeout requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013119

SECTION 013216 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 CONSTRUCTION PROGRESS SCHEDULE

A. General

1. The Contractor's CONSTRUCTION PROGRESS SCHEDULE (Schedule) shall be based upon a Critical Path Method (CPM) analysis of construction activities and sequence of operations needed for the orderly performance and completion of all separable parts of the Work in accordance with the Contract and within the Contract Time. The Schedule shall be a critical path method type in the form of a precedence diagram and activity listing, and shall be time scaled. It shall include the Date of Notice to Proceed, Date(s) of Substantial Completion, and Date(s) of Final Completion in accordance with the Contract Documents, and all other information included on the CONSTRUCTION PROGRESS SCHEDULE CHECKLIST contained herein. The Schedule shall be developed using Microsoft Project or software acceptable to the Owner.
2. The Network Diagram shall show in detail, and in order, the sequence of all significant activities, their descriptions, start and finish dates, durations and dependencies, necessary to complete all Work and any separable parts thereof. The Activity Listing shall show the following information for each activity on the Network Diagram:

    a. Description;
    b. Duration (not to exceed 15 days);
    c. Trade;
    d. Equipment (including hours of usage)
    e. Start and finish dates;
    f. Total float time and free float time; and
    g. Dates that must be performed and completed by other contractors or subcontractors to support the Work and the interfaces with other contractors and subcontractors.

3. A schedule for the purchase and receipt of items required for performance of the Work, showing lead times between purchase order placement and delivery dates, shall be integrated into, coordinated with and indicated on the Contractor's CONSTRUCTION PROGRESS SCHEDULE. The Contractor shall furnish the Architect copies of the following documents within ten (10) days of Contractor's receipt of same, for all items on the Critical Path:

    a. Purchase orders and acknowledgments of fabrication; and
    b. Production and shipping schedules.

c. Neither the Architect nor the Owner shall be deemed to have accepted any such material, or its schedule, nor deemed to have waived this requirement if some or all of the above referenced documentation is not received.

4. Milestones shall be clearly defined, integrated, coordinated with, and indicated on, the Contractor's Construction Progress Schedule. Milestones on the critical path shall occur at intervals not exceeding fourteen (14) days, with progress tracked and reviewed at weekly meetings.
5. If abbreviations are used in the Contractor's Construction Progress Schedule, a legend shall be provided to define all abbreviations.
6. The Contractor shall prepare and keep current a SCHEDULE OF SUBMITTALS, integrated and coordinated with the Contractor's Construction Progress Schedule, which allows the Architect and Owner at least ten (10) working days or as otherwise provided for in the Contract Documents, to review and return each submittal or re-submittal. This shall apply to all submittals, including all those on the critical path.
7. Within ten (10) working days after receipt by the Architect, two (2) copies of the Contractor's Construction Progress Schedule and attached Checklist, certified by the Contractor, will be returned to the Contractor. The Architect's review will be focused primarily on the completeness of the Schedule as determined by evaluation of the accompanying Checklist. Review by the Owner and/or Architect of the Contractor's Construction Progress Schedule shall not constitute an approval or acceptance of the Contractor's construction means, methods or sequencing, or its ability to complete the Work in a timely manner.
8. The Contractor shall utilize and comply with its Construction Progress Schedule. The Contractor shall not be entitled to any adjustment in the Contract Time, the Contract Sum, or the Construction Progress Schedule, or to any additional payment of any sort, by reason of the loss or use of any float time (the amount of time that one or more activities may be delayed without causing delay to the contract Date of Substantial Completion), by either the Owner or the Contractor, including time between the Contractor's anticipated completion date and end of Contract Time, whether or not the float time is described as such on the Contractor's Construction Progress Schedule.
9. The Contractor shall submit an updated Construction Progress Schedule on a monthly basis, coinciding with the monthly submittal of its preliminary Application for Payment. The updated schedule shall indicate actual work completed and shall make adjustments to those activities where the Contractor has not met the scheduled dates as shown on its current schedule. The updated schedule shall also reflect any changes in the Contractor's sequence of work. Each updated monthly Construction Progress Schedule shall be in full compliance with contract requirements, including dates of Substantial and Final Completion.
10. The Contractor shall, within seven (7) calendar days of the event, notify the Owner and Architect, in writing, of any proposed changes in the Contractors Construction Progress Schedule, or the Contract Time, resulting from or caused by the event, and of any event that could delay performance or supplying of any item of the Work, and shall indicate the expected duration of the delay, the anticipated effect of the delay on the Contractor's Schedule, and the action being

taken to correct the delay situation. In the event the Contractor is entitled to a change in the Contract Time, the adjustment to the Contract Time shall be limited to the change in construction activities on the Critical Path as authorized by Changes in the Work.

11. The Contractor shall achieve Final Completion of the Work in accordance with the General Conditions and Form of Agreement.

B. Schedule Format and Content

1. The format and content of the Contractor's Schedule shall be as indicated on the Contractor's Construction Progress Schedule Checklist included at the end of this Section. The Checklist shall be completed and certified by the Contractor and submitted with the initial Construction Progress Schedule.

C. Schedule/Report Submittals

1. All schedules and reports shall be submitted in both hard copy and machine-readable electronic format.
2. Initial Submittal:

   a. Submit initial Schedule and certified Checklist for review within ten (10) days after Award of Contract. Architect will review and return within ten (10) days of receipt.

3. Resubmittal

   a. If required, resubmit within seven (7) days after return of Initial Submittal.

4. Distribution

   a. Following initial submittal to and response by Architect, print and distribute Construction Progress Schedule, including Submittal Schedule/Report, Critical Path Material Delivery Report and any other Report requested by the Owner that should be printable from the information contained in the Schedule's data base. Distribute schedules and reports to Architect, Owner, principal subcontractors, suppliers or fabricators, and others with a need to know the schedule. Post copies in project meeting rooms and field office. Distribute and post subsequent updated issues to same entities when revisions are made, except delete entities from distribution when they have completed assigned Work, and are no longer involved in performance of scheduled Work.

D. Use of Float Time

1. The actual construction shall comply with the Contractor's Construction Progress Schedule. Any float time in addition to that which is required in the General Conditions shall be deemed to be for the joint use of the Owner and the Contractor, provided that in the event of any conflicting need for, or any overlapping use of, any float time, the Owner shall have priority and the

Contractor shall not be entitled to an extension of the activity(ies) or Contract Time, or to any additional payment of any kind due to the Owner's use of the float time.

E. Inclement Weather

1. The Contractor's Schedule shall anticipate, and include provisions for, a minimum of seven (7) workdays of unforeseen or exceptionally inclement weather that will negatively impact the Work. The Contractor shall identify additional days of anticipated inclement weather, as necessary, based on its own analysis of historical data, a copy of which shall be provided to Owner upon request. The Contractor's use of one or more days of anticipated yet unforeseen inclement weather is subject to the Contractor's submittal of substantiating data based on standards established by University of Washington and National Oceanic and Atmospheric Administration, and requirements of General Conditions. Anticipated unforeseen inclement weather shall be included as a critical path activity on the Schedule.

F. Schedule of Submittals:

1. Schedule of Submittals (shop drawings, product data, samples and all other required submittals) shall be coordinated with and incorporated in the Construction Progress Schedule.
2. Schedule of Submittals may be presented as a report generated from the CPM database to simplify printing of CPM schedule.

1.3 SHORT-TERM INTERIM PROJECT SCHEDULE AND REPORT

A. Contractor shall submit on a weekly basis, coinciding with the weekly Construction Progress Meetings, a short-term schedule, in bar chart form, indicating work completed the previous week and work scheduled for the following two (2) week period. Schedule shall be updated weekly.

B. Schedule shall include deliveries, submittals, COP and CCD Work identified by document number, and commissioning activities per Division 01 Section "General Commissioning Requirements."

C. Short-term Interim Schedule shall be derived from and correlated with the Construction Progress Schedule, with corresponding activity names and numbers.

D. Contractor shall submit on a weekly basis, together with the short-term interim project schedule, a written report, in a form acceptable to the Owner, comparing the previous week's actual progress to the progress indicated on the previous week's schedule.

1.4 OWNER OCCUPANCY

A. The Western State Hospital Food Services (Kitchen) operates on a full time basis. The Owner will begin operations in the new kitchen facility while maintaining the operations at the existing kitchen facility for a period of two weeks. Existing equipment cannot be

relocated from the existing kitchen to the new building until after this two week period is completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

CONSTRUCTION PROGRESS SCHEDULE CHECKLIST
(To be submitted with Contractor's Initial Schedule Submittal)

The Contractor shall complete the following checklist addressing format and content of Contractor's Construction Progress Schedule. For submittal to be complete, all boxes must be checked, and each item certified (initialed) by the Contractor. Architect shall review schedule and confirm that each item is complete.

NO.	DESCRIPTION	CONTR. CERT.	ARCH. CERT.
☐ 1.	Titled "Construction Progress Schedule"	_____	_____
☐ 2.	Date of original submittal with revision date for each update	_____	_____
☐ 3.	Paper size and production method suitable for updating and reproduction throughout duration of project	_____	_____
☐ 4.	Time-Scaled CPM network diagram indicating project completion at Contract Date of Final Completion	_____	_____
☐ 5.	Indicate no more than one (1) critical path	_____	_____
☐ 6.	Activity Type CPM Schedule clearly identifying the activity and time required for the activity	_____	_____
☐ 7.	Plotted to a calendar-day-based horizontal time scale divided into weekly increments.	_____	_____
☐ 8.	Logical sequence of the Work to be accomplished.	_____	_____
☐ 9.	Order and interdependence of the planned activities. Indicate CPM dummy Constraints.	_____	_____
☐ 10.	Resource Loaded (labor, materials & equipment).	_____	_____
☐ 11.	No activity longer than 15 calendar days.	_____	_____
☐ 12.	Indicate phases or major areas of construction of the CPM Schedule by logically grouping activities and indicating phase or area in large print.	_____	_____
☐ 13.	Start and finish dates, and lag or overlap of each major element of construction.	_____	_____
☐ 14.	Projected percentages of completion for each item on last day of each pay period.	_____	_____
☐ 15.	Include work to be performed by others, if any.	_____	_____

☐ 16.	Required actions of Owner materially and/or logically affecting completion date.	_____	_____
☐ 17.	Delivery dates of all major items, especially long lead time items.	_____	_____
☐ 18.	All interconnecting phases of work among trades, especially where one trade's work affects the schedule of others.	_____	_____
☐ 19.	All work affected by seasonal conditions.	_____	_____
☐ 20.	Construction of all facilities.	_____	_____
☐ 22.	Activities correlated with Specification Sections and Sub-sections	_____	_____
☐ 24.	Inclement weather on critical path.	_____	_____
☐ 25.	Date building envelope is complete (dried in).	_____	_____
☐ 26.	Date power to the building is energized.	_____	_____
☐ 27.	Date HVAC equipment ready to be energized. (3 months prior to Substantial Completion)	_____	_____
☐ 28.	Date Building Automation System with HVAC controls ready. (2 months prior to Substantial Completion)	_____	_____
☐ 29.	Date for Cx Functional Performance Tests. (1 month prior to Substantial Completion)	_____	_____
☐ 30.	Suspended Ceiling Grid ready for Cover.	_____	_____
☐ 31.	Building Flush-out (for each program area).	_____	_____
☐ 32.	TAB Preliminary Report complete.	_____	_____
☐ 33.	Identify all float times, including total days.	_____	_____
☐ 34.	Incorporates Schedule of Submittals	_____	_____
☐ 35.	Correlated with Schedule of Values.	_____	_____
☐ 36.	Clearly identify Closeout Phase. Identify all major activities and submittals individually. Schedule must show a clear understanding of the relationships between, and requirements for, Substantial Completion, Punch Lists, Site Cleaning, Site Maintenance, Record Documents, Final Completion, Final Acceptance, etc.	_____	_____
☐ 37.	Identify all instances of required Notifications from Contractor related to specific events such as Commissioning, Substantial Completion, etc.	_____	_____
☐ 38.	Identify Commissioning activities and milestones and related items.	_____	_____
☐ 39.	Two-week concurrent kitchen operation period.	_____	_____
☐ 40.	All other requirements of this and other applicable Sections, whether listed here or not.	_____	_____

END OF SECTION 013216 ss: November 8, 2017

SECTION 013323 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 GENERAL

A. This section includes administrative and procedural requirements for project submittals including, but not limited to, product information, shop drawings, manufacturer's instructions and certificates, and samples.

1. Individual submittal requirements are specified in applicable sections for each unit of work.
2. Submittals shall be made early enough to account for processing described herein and a reasonable period for thorough review by the Architect and Engineers. Submittals requesting action in less than ten (10) working days shall be deemed untimely submittals and shall be documented as such.
3. Maintain Schedule of Submittals; transmit at or before time indicated.

a. Proposed Schedule of Submittals shall be incorporated into initial Construction Progress Schedule and shall be submitted in a report format within 15 workdays after Notice to Proceed.

B. The Contractor is responsible for providing the Commissioning Authority with copies of the following information for inclusion in the Systems Manual. The Commissioning Authority will compile the final Systems Manual based on the contractor submitted documentation along with additional material provided by the Commissioning Authority.

1. As-built documents
2. Description of systems, including capabilities and limitations
3. Operating procedures for all normal, abnormal, and emergency modes of operation
4. Sequence of operation as actually implemented, with control system data including all set points, calibration data, etc.
5. Location of all control sensors and test ports.
6. Seasonal start-up and shutdown procedures.
7. Control schematics and computer graphics
8. Complete terminal interface procedures and capabilities for DDC systems.
9. A list of recommended operational recordkeeping procedures including sample forms, trend logs, or others, and a rationale for each
10. Maintenance procedures

1.3 FORMAT

A. Identify each submittal with date, project title, detail number and specification section, and re-submittal information if applicable.

B. Contractor shall stamp and sign each submittal indicating compliance with field dimensions and Contract Documents and/or substitutions allowed by Addenda.

C. Include a Submittal Transmittal form (sample copy bound herein) with each submittal indicating specification section. Do not reference more than one specification number on a single Submittal Transmittal form. The Submittal Transmittal form shall be used by all parties as the cover sheet for all submittal transmittals.

1. Provide one (1) copy transmitted electronically with the exception of samples for color or finish selection.
2. Provide minimum of five (3) copies of each sample for color or finish selection, or for submittals that cannot be transmitted electronically:

D. Coordinate submittal of different units of interrelated work so that no submittal will be delayed by the Architect's need to review a related submittal. The Architect reserves the right to withhold action on any such submittal until the related submittals and/or samples are received.

E. Indicate need for Architect/Owner selection, if any.

F. Deviations: Any deviations from Contract Documents in submittals shall be clearly and distinctly denoted.

G. Reference to work "by other" or “by others”, or any similar designation, shall be assumed to mean "by Contractor" unless otherwise noted. Unless specifically referenced as work or materials “by Owner,” work or materials referenced shall be interpreted as being included in the Contract.

1.4 SUBMITTALS REQUIRED

A. Submittals include but are not limited to:

1. Identification of subcontractors.
2. Construction Progress Schedules.
3. Site plan indicating usage for staging, storage, temporary controls, etc.
4. Shop drawings, product data, and samples.
5. Mock-ups.
6. Quality Control Plan per Division 01 Section “Quality Requirements.”
7. Schedule of Values per Division 01 Section “Schedule of Values.”
8. Contract closeout requirements.
9. Operation, Maintenance and Warranty Manuals.
10. Certificates of Compliance.
11. Project Record Documents.
12. Operation and Maintenance Data.
13. Extra materials or spare parts.

1.5 LEED SUBMITTALS

A. Summary of Required Submittals. There are a number of submittals required to create the LEED Application. These submittals are provided in the related product sections; a summary of LEED related submittals is provided here for reference only.

1. Credit SSc7.1: Heat Island Effect, Non-Roof

a. Cut sheets for paving system surfaces highlighting the Solar Reflectance Index (SRI) of the installed materials.

2. Credit SSc7.2: Heat Island Effect, Roof

a. Cut sheets for each roofing material that highlights the Solar Reflectance Index (SRI) of the installed materials.

3. Credit WEc1: Water Efficient Landscaping

a. Cut sheets for irrigation equipment, including manufacturer information about distribution efficiency.

4. Credit WEc3: Water Use Reduction

a. Cut sheets for all water consuming plumbing fixtures, with flow rates and/or metering volume highlighted.
b. Cut sheets for plumbing fixtures which do not consume water such as composting toilets or waterless urinals.

5. Prerequisite EAp3: Fundamental Refrigerant Management and Credit EAc4: Enhanced Refrigerant Management

a. Cut sheets for all mechanical HVAC&R components highlighting refrigerant information.

6. Credit MRc2: Construction Waste Management

a. Completed LEED Online Credit Form.
b. Construction Waste Management plan.
c. Construction Waste Management progress reports, including monthly photo documentation of construction waste management procedures and on-site bins.
d. Documentation of recovery rate, if commingled.
e. Waste hauling certificates or receipts.
f. Final Construction Waste Management Report as described in Section 017419 Construction Waste Management and Disposal.
g. Include a brief narrative explaining how and to where each waste type has been diverted

7. Credit MRc4: Recycled Content

    a. Completed LEED Online Credit Form containing a list of all recycled content materials used on the project, and their cost.
    b. Cut sheets or other documentation for each product/material highlighting recycled content information.
    c. Completed LEED Materials Submittal Form (attached to this section) for each product used.

8. Credit MRc5: Regional Materials

    a. Completed LEED Online Credit Form containing a list of all materials manufactured and harvested/extracted within 500 miles of the project site, their cost, and the location of manufacture and harvest/extraction.
    b. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction.
    c. Completed LEED Materials Submittal Form (attached to this section) for each product used.

9. Credit MRc7: Certified Wood

    a. Certificate or other documentation for each FSC product/material highlighting the FSC Chain of Custody (CoC) number.
    b. Invoices for all wood products purchased, with the following identified:
    c. FSC certified wood products and the associated (CoC) number for each product.
    d. Itemized costs for all wood products
    e. Vendor FSC CoC number
    f. Completed LEED Materials Submittal Form (attached to this section) for each product used.

10. Credit EQc3.1: Construction Indoor Air Quality Management Plan, During Construction

    a. Completed LEED Online Credit Form.
    b. Construction IAQ Management Plan.
    c. Photographs of construction IAQ management measures such as protection of ducts and on-site stored or installed absorptive materials.
    d. Cut sheets of filtration media used during construction and installed prior to occupancy with MERV values highlighted.

11. Credit EQc3.2: Construction Indoor Air Quality Management Plan, Before Occupancy

    a. Completed LEED Online Credit Form.
    b. Construction IAQ Management Plan, stating flush-out or air quality testing procedures.
    c. Copy of IAQ testing results if testing is performed.

12. Credits EQc4.1 & EQc4.2: Low-Emitting Materials – Adhesives, Sealants, Paints, and Primers

    a. Completed LEED Online Credit Form.
    b. Completed LEED VOC Submittal Form attached to this section for each adhesive, sealant, paint, and primer product used inside the vapor barrier.
    c. Material Safety Data Sheet (MSDS) highlighting VOC content for each adhesive, sealant, paint and primer product used inside the vapor barrier.
    d. Summary table comparing credit requirements and actual VOC levels for each product.

13. Credit EQc4.3: Low Emitting Materials, Flooring Systems

    a. Completed LEED Online Credit Form.
    b. Cut sheets or letters from product manufacturers indicating that carpet products meet the CRI Green Label Plus IAQ Test Program requirements.
    c. Cut sheets or letters from product manufacturers indicating that hard surface flooring products comply with the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.
    d. Completed LEED Materials Submittal Form (attached to this section) for each product used.
    e. Summary table listing each carpet used on the project.

14. Credit EQc4.4: Low-Emitting Materials, Composite Wood & Agrifiber Products

    a. Completed LEED Online Credit Form.
    b. Cut sheets indicating that the bonding agents for each composite wood and agrifiber product used in the project do not contain added urea formaldehyde resins.
    c. Completed LEED Materials Submittal Form (attached to this section) for each product used.
    d. Cut sheets indicating that the laminating adhesive products used in the project do not contain added urea formaldehyde.
    e. Summary table listing each composite wood product used on the project. For each product, list the bonding agent used

1.6 LEED™ REPORTING FORMS

A. Complete the forms listed below, and as required by other Sections.

1. LEED Online Credit Form (see sample form at the end of this Section): PDF file that prompts the responsible party to declare that the requirements of each prerequisite and credit are met. This document can be accessed by registered users to the LEED Online application system.
2. LEED Materials Submittal Form (see sample form at the end of this Section): Form to be provided to each subcontractor to record LEED materials used on the project.
3. LEED VOC Submittal Form (see sample form at the end of this Section): Form to be provided to each subcontractor to record VOC content for all adhesives, sealants, paints and primers used on the inside of the vapor barrier of the project.

1.7 DEFINITIONS

A. Submittals: Manufacturer's published product information, shop drawings, samples, certifications, guarantees, and the like as required by individual Specification Sections and as requested by Architect or Architect's consultant.

B. Product Information: Manufacturer's published technical product information and data, including but not limited to the following: catalogs, catalog cuts, color charts, standard wiring diagrams, printed performance curves, operational range diagrams, mill reports, written installation instructions, standard operating and maintenance manuals, and other relevant information. Where product information must be specifically prepared because standard printed data is not suitable for use, submit as "shop drawings."

C. Shop Drawings: Technical drawings and data, prepared by Contractor, required by the Specifications or the performance of the Work for this project including, but not limited to fabrication and installation drawings, setting diagrams, shop work manufacturing instructions, templates, patterns, coordination drawings (for use on-site), schedules, design mix formulas, Contractor's engineering calculations, and other relevant information.

D. Samples: Physical examples of Work including, but not limited to partial sections of manufactured or fabricated Work, small cuts or containers of materials, complete units of repetitively-used materials, units of work to be used for independent inspection and testing, and other relevant information. Unless otherwise approved in writing by the Architect, samples shall be of the precise article, material, or finish proposed to be incorporated into the Work.

1.8 SUBMITTALS – GENERAL REQUIREMENTS OF CONTRACTOR

A. Pay all costs for materials, reproduction, delivery, and distribution.

B. Pay all costs for additional materials, reproduction, delivery, distribution, and impact on Time of Completion in the event that initial submittals are not approved for failure to comply with the project requirements and requirements of this Section, including content and format of submittal.

C. Contractor's submittals reviewed by the Architect or Architect's consultant are not modifications to the Contract. The purpose of Contractor's submittals is to demonstrate to the Architect or Architect's consultant that the Contractor understands the design concept. Contractor demonstrates his understanding of the design by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

D. Assume responsibility for satisfactory performance of the Work and for assuring that all materials furnished meets all requirements of the Contract Documents.

E. Assume responsibility for checking, confirming, and correlating quantities, dimensions and space requirements at the Project Site, for selecting fabrication processes and techniques of assembly, for coordination of Work with other trades, for union jurisdiction, for infringement of patent rights, and for possible cause of injury to persons or property.

F. Markings or comments by Architect or Architect's consultant on submittals shall not be construed as relieving the Contractor from compliance with the requirements of the Contract Documents, nor departures therefrom.

G. Instruct affected parties to promptly report in writing any inability to comply with provisions of this Section.

H. Architect or Architect's consultant's review of submittals is only for general compliance and conformity with the design concept and provisions of the Contract Documents. Any action indicated is subject to the requirements of the Contract Documents. Architect or Architect consultant's review of separate items does not constitute review of assembly in which it functions.

I. Telegraphic and facsimile (FAX) submittals are not acceptable unless approved in advance by Architect. Telegraphic and facsimile transmittals shall be followed up with original copies as required.

1. Electronically transmitted submittals in PDF or similar format are acceptable.

J. Reproduced or copied Contract Documents as the basis for submittals are not acceptable, and if received as a submittal, will be rejected.

K. In no case is the Contractor relieved of responsibility for deviations, errors, or omissions in any submittals which would, in effect, modify the Contract Documents or their "intent;" unless specifically brought to the Architect's attention and approved in writing. There is no implied change, approval or responsibility on the Architect in reviewing submittals and giving approval even when they may be unknowingly incorrect or incomplete in some portion.

1.9 SUBMITTAL PROCEDURES

A. Submittal Scheduling:

1. Process and make submittals in such sequence in advance of scheduled dates of installation to expedite the project, to secure required approvals from public Authority Having Jurisdiction (AHJ), and as required to allow reasonable time (14 calendar days for each submittal or re-submittal unless indicated otherwise) for Architect's review. Allow additional time as required for review by Architect's consultants and/or possible revision and re-submittal.
2. Allow sufficient time for the processing, transmitting, review, and return of submittals to cause no delay in the Work.
3. Failure to make submittals to allow sufficient time for checking and review by Architect or Architect's consultant shall not entitle Contractor to an extension of Time of Completion, Substantial or Final.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Prior to transmitting submittal to Architect, fully coordinate all material including the following:

1. Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.
2. Coordinate preparation and processing of submittals with all trades, public agencies involved, and performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay. Obtain necessary approvals from public Authorities Having Jurisdiction (AHJ) and obtain written evidence of approval by stamp, letter, or other acceptable means.
3. Make submittals in groups containing all associated or related items.
4. Coordinate each submittal with fabrication, purchasing, testing, delivery, and other submittals and related activities that require sequential activity.
5. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. Architect and Architect's consultants reserve the right to withhold review-action on a submittal requiring coordination with other submittals until related submittals are received. Architect will advise the Contractor when a submittal being processed must be delayed for coordination.

C. Contractor's Certification:

1. Apply Contractor's signed and dated stamp or label to each page of submittal, certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Contract Documents. Size of stamp or label shall be not less than 2 inches by 3 inches.

CONTRACTOR'S CERTIFICATION SHALL BE WORDED AS FOLLOWS:

"It is hereby certified that the material shown and marked in this submittal is that proposed to be incorporated into the Work under this Contract, is in compliance with the Contract Documents, can be installed in the allocated spaces, and is submitted for acceptance."

Certified by _____ Date _____

For: _____
(Contractor)

2. Submittals without evidence of Contractor's completed certification stamp will be returned to the Contractor without review. Resubmit with required certification stamp.

D. Variation from Contract Documents: Furnish written description, separate from submittal, of how submittals vary from requirements of the Contract Documents.

E. Submittal Identification, Log, and Transmittal:

1. Submittal Identification Numbers shall consist of the Specification Division Number and a 2-digit sequential number, separated by a hyphen (e.g. 09-01) Resubmittal Identification Numbers shall consist of the original Submittal Number followed by a sequential revision number (e.g. 09-01R1).
2. Allow space on each submittal for Contractor's certification stamp and Architect or Architect's consultant's review-action stamp.
3. Maintain a submittal status log for tracking submittals. List all submittals required and indicate actions required by Contractor, Owner, Architect, or Architect's consultant.
4. Transmit each submittal separately with an individual Submittal Transmittal form signed by the Contractor. This form shall serve as cover sheet and transmittal and no additional paperwork shall cover this form. Attach additional sheet(s) if required.
5. Transmit submittals for each Specification Section under separate transmittal form.
6. Package each submittal appropriately for transmittal and handling. Submittals received from sources other than the Contractor will be returned without review-action unless approved by the Architect before submittal.

F. Review-Action & Return of Submittals:

1. Architect or Architect's consultant will review each submittal, mark with a uniform, review-action stamp, appropriately marked to indicate status of submittal.

a. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," or similar phrase, that part of the Work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents; final acceptance will depend upon that compliance.

b. Final-But-Restricted Release: Where submittals are marked "Make Corrections Noted," "Revise As Indicated," or similar phrase, that part of the Work covered by the submittal may proceed provided it complies with the notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend upon that compliance.

c. Returned for Re-submittal:

1) When submittal is marked "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat as necessary to obtain a different action mark.

2) When submittal is marked "Rejected," "Not Approved," or similar phrase, do not proceed with that part of the Work covered by the submittal including purchasing, fabrication, delivery, or other activity. Review cannot proceed because minimum requirements have not been met. Revise or prepare a new submittal in and resubmit without delay. Repeat as necessary to obtain a different action mark.

2. Do not permit submittals returned for re-submittal to be used in any part of the Work until Architect's release is obtained.

3. Where a submittal is primarily for information or record purposes, special processing, or other activity, the submittal will be returned to Contractor marked "Action Not Required."

G. Re-submittals:

1. Make corrections and changes in the submittals required by Architect or Architect's consultant.
2. Identify all revisions made on re-submittals.
3. Indicate other changes that have been made other than those required by Architect or Architect's consultant.
4. Resubmit until approved.

H. Distribution: Distribute approved copies of submittals to:

1. Project Site job file.
2. Record Documents file.
3. Other affected Contractors.
4. Subcontractors, Suppliers, and Fabricators.
5. Other affected parties, as appropriate.

1.10 PRODUCT INFORMATION

A. Mark each submittal to identify applicable products, models, options, and other data. Delete inapplicable information. Supplement manufacturers' standard data to provide

pertinent information unique to this project. Furnish evidence of compliance with required reference standards.

1.11 SHOP DRAWINGS

A. General:

1. Present shop drawings in a clear and thorough manner.
2. Reproduced or copied Contract Documents or standard information as the basis for shop drawings are not acceptable, and if received as a shop drawing they will be rejected.
3. Freehand-drawn shop drawings are not acceptable.
4. Size of shop drawing sheets or PDF formatted sheets shall be not less than 8 1/2 inches by 11 inches and not more than 36 inches by 42 inches.
5. Draw plans and details to scale(s) not less than as indicated in individual Specification Sections, or, if not indicated, to a scale sufficiently large to clearly show all pertinent features, method of fabrication and connections.
6. Delete inapplicable information from manufacturer's standard schematic drawings and diagrams and supplement them as required to provide pertinent information unique to this project.

B. Include the following information:

1. Name of the firm that prepared each shop drawing.
2. Project identification.
3. Identification of products and materials and compliance with specified standards.
4. Indication by whom materials, items, and installation not supplied or performed by entity submitting shop drawings will be supplied or installed. Every item, material, article, or note on installation, shown or required for fabrication or installation shall be so designated. Do not use the expression "by others" or similar expressions.
5. Reference to Architect's or Architect's consultant's drawing and detail identification.
6. Relation to adjacent structure or materials.
7. Size, type, dimension, and location of all components, jointing, connections, and the like.
8. Fabrication methods, assembly, installation, accessories, fasteners, and other pertinent information.
9. Field dimensions, clearly identified.
10. Notation of coordination requirements.

C. Shop Drawings without required information will be rejected.

D. Submit in the form of three (3) opaque prints per shop drawing, unless submitted electronically in PDF or CAD format. Roll copies, do not fold.

E. Make number of required prints from approved copy for Contractor's, Subcontractors', Suppliers', Fabricators', and others' use (including that required for inclusion in operation and maintenance manuals as specified.

1.12 MANUFACTURER'S INSTRUCTIONS

A. When required by individual Specification Sections and as requested by Architect or Architect's consultants, submit manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, and finishing of products to Architect for review and approval.

B. Identify in writing conflicts between manufacturer's instructions and Contract Documents.

1.13 MANUFACTURER'S CERTIFICATES

A. When required by individual specification Sections and as requested by Architect or Architect's consultants, submit manufacturers' certificates to Architect for review and approval.

B. Indicate material or product complies with, or exceeds, specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates must be most recent test results on material or product, and must be acceptable to Architect or Architect's consultant.

1.14 SAMPLES

A. Submit number of samples Contractor requires plus two (2) additional samples which will be retained by the Architect or Architect's consultant. When variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than three (3), that show approximate limits of the variations. Provide additional sample as requested by Architect or Architect's consultant.

B. Samples retained by Architect and Architect's consultant may be used for quality control comparison of visual characteristics between the final sample submittal and the actual Work as it is delivered and installed.

C. Refer to individual Specification Sections for additional sample requirements that may be required for examination or testing of additional characteristics. Compliance with other requirements is the exclusive responsibility of the Contractor and such compliance is not considered in the Architect's or Architect's consultant's review and action indication on sample submittals.

D. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices, to Architect for review and approval.

E. Coordinate sample submittals for interfacing work.

F. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection, unless indicated otherwise in individual Specification Sections.

G. Include identification on each sample, with full project information.

H. In certain cases as required in the individual Specification Sections or as approved in advance in writing by Architect, samples too large for handling as outlined herein may be prepared and maintained at the project site. Architect may waive retention of sample at the time of completion and may waive required quantity requirements.

I. Samples will be reviewed for visual qualities only. Compliance with other requirements is the exclusive responsibility of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

See next page for LEED Submittal Templates

Materials Submittal Form

Project Name: _____

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for **each building material** (i.e. drywall, insulation, steel studs, etc) that you will be furnishing to the project. Wet-applied products are not included – please refer to the VOC Submittal Form.

Please fill out all of the information requested in the box below. Write "N/A" or "?" for information that does not apply or is undetermined. For questions about completing this form, please contact the general contractor for the project.

Sub-Contractor: _____ **Spec Section:** _____

Contact: _____ **Material Name:** _____

Date: _____ **Manufacturer:** _____

Material Cost (minus on-site labor and equipment): $ _____

Material Source Location:

Location of Manufacture*: _____ City/State

_____ Miles from the project site

Location of Harvest/Extraction**: _____ City/State

_____ Miles from the project site

☐ I have attached manufacturer documentation stating the location of manufacture and harvest/extraction.

Recycled Content†:

% Post-Consumer: _____ %

% Post-Industrial: _____ % (Combined total cannot equal >100%)

☐ I have attached manufacturer documentation stating the percentage of recycled content.

Signature: **Date:**

_____ _____

* Manufacturing refers to the final assembly of components into a building product. For example, the location of manufacture for structural steel would be the address of the fabrication shop (not the steel mill).

** Location of Harvest is where raw materials were extracted from the ground. For example, the location of harvest for gypsum is the gypsum mine. If the gypsum is recycled, then the harvest location is the gypsum recycling plant.

† Post-consumer content is from previous consumer use (bottles, cars) and post-industrial content is recaptured from the industrial process (fly ash, metal trimmings). If the type of recycled content is not specified, assume it is post-industrial.

Materials Submittal Form
Concrete

Project Name: _____

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for each different concrete mix that is used for the project.

Please fill out the information below. Gray boxes may be left blank. Write "N/A" or "?" for information that does not apply or is undetermined. For questions, please contact the contractor from whom you received this form.

Sub-Contractor: _____ Manufacturer: _____

Date: _____ Contact: _____

Concrete		
	Cost per cubic yard of mix (minus labor and equipment):	$
	Volume of concrete provided (cubic yards):	CY
	Location of Manufacture[1]: City/State	
	Miles from project site	

Concrete Mix Name/Number: _____

Component[2]	% of mix (by weight)	% Recycled Content[3] (Post-Consumer)	(Post-Consumer)	Location of Harvest[4] (City, State)	Miles from Project
Cement					
Flyash			100%		
Aggregate 1: _____					
Aggregate 2: _____					
Sand					
Other: _____					

☐ **I have included a manufacturer mix report that confirms the information in this chart.**

Signature: _____ **Date:** _____

[1] Location of Manufacture refers to the address of the facility where the mix was combined.
[2] Water and chemical additives may be omitted from the component list.
[3] Post-consumer content is from previous consumer use (ex: crushed pavement) and post-industrial content is recaptured from the industrial process (ex: fly ash). If the type of recycled content is not known, assume it is post-industrial.
[4] Location of Harvest is where raw materials are extracted from the ground. For example, the location of harvest for aggregate is where the stone was mined. If the aggregate is recycled, then the harvest location is where the rock was crushed for recycling.

Materials Submittal Form
Wood Products

The project team is using the LEED Rating System® (www.USGBC.org/LEED) to measure the environmental impacts of the project. Therefore, the project team is pursuing and tracking materials the types of materials that are being used to construct the project.

Please fill out the information in the box below for each wood material that you will be furnishing to the project. Write "N/A" in any field that does not apply and a "?" for any information that you are unable to determine.

Contractor: _____ **Spec Section:** _____

Contact: _____ **Material Name:** _____

Date: _____ **Manufacturer:** _____

Material Cost (minus labor and equipment): $_____

☐ I have attached invoices for all wood products[1].

[1] All invoices must: identify each wood product on a line-item basis; identify each FSC product on a line-item basis; include the dollar value for each line-item; and include the vendor's FSC Chain of Custody number if the invoice includes FSC items.

Material Source Location

Location of Fabrication: City/State _____ Miles from project site _____

Location of Forest: City/State _____ Miles from project site _____

Recycled Content[2]

Post-Consumer Content: _____ % Pre-Consumer / Post-Industrial Content: _____ %

☐ I have attached manufacturer documentation stating the percentage of recycled content.

[2] Post-consumer content is waste that has been recaptured after consumer use. Post-industrial content is recycled waste that has been captured from industrial processes. If the type of recycled content is not specified, assume it is post-industrial.

Salvaged Wood Content[3] _____ %

☐ I have attached manufacturer information stating where the wood was salvaged from.

[3] Salvaged wood comes from the deconstruction of another building or structure.

FSC Certified Wood[4]

Chain of Custody Certificate Number: _____

☐ I have attached a copy of the FSC Chain of Custody Certificate or Manufacturer documentation stating the product or product component is FSC certified.

[4] Only Forest Stewardship Council (FSC) certification qualifies for LEED compliance. Sustainable Forest Initiative (SFI) or other certification bodies DO NOT QUALIFY and are not acceptable substitutions for FSC certification.

Composite Wood Content[5]

Contains Urea-Formaldehyde Resins? _____ (Y/N)

☐ I have attached manufacturer documentation stating that the composite wood DOES NOT contain any added urea-formaldehyde resins.

[5] Composite wood products include plywood, MDF, particleboard, wheatboard, bamboo, etc. Laminating adhesives used for shop fabrication and on-site fabrication of composite assemblies must also be free of added urea-formaldehyde resins.

Signature: _____ **Date:** _____

VOC Submittal Form

Project Name: _____

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Rating System®. A major goal of this program is to reduce the quantity of indoor air contaminants that are odorous or potentially harmful to the well-being of installers and occupants. To fulfill the requirements of this program, **this form must be completed for each product that is wet-applied within the interior vapor barrier of the project**.

All products must be compliant with the Volatile Organic Compound (VOC) limitations that are reported on page two of this document. Please refer to the Pre-Approved Products List for product suggestions. If an alternative product is selected, please provide a copy of the Material Safety and Data Sheet (MSDS) with the VOC Submittal Form. The MSDS must state VOC content in **grams per liter.** If this information is not included in the MSDS, please request the VOC content (in grams/liter) from the manufacturer. Do not assume a zero VOC content if the information is not shown.

Please fill out the information in the chart below:

Sub Contractor: _____ **Spec Section:** _____

Contact: _____ **Date:** _____

I plan on using the following VOC containing Adhesives, Sealants, Primers and/or Paint on the interior of the project:

Product Name: (manufacturer and product ID)	**Type of Product:** (adhesive, sealant, paint, etc)	**The product is used for:** (application description)	**VOC Content in g/L** (from attached MSDS)	**Allowable VOC Content in g/L** (from charts on the next page)

☐ **I have attached a copy of the MSDS stating the VOC content for each product listed above.**

By signing below, I hereby confirm that these are the only wet-applied products that I will use on the interior of the building.

Signature: _____ **Date:** _____

If you have any questions, please contact the general contractor.
Thank you for complying with the LEED requirements and contributing to the goals of this project.

END OF SECTION 013323

NAC
ARCHITECTURE

Submittal/Shop Drawing Transmittal

Instructions

1. Contractor reviews and stamps the submittal. Complete Part 1 of this form, attach only (1) submittal specification section to each transmittal and distribute in accordance with project requirements.
2. Architect's Consultants complete Part 2, attach annotated/stamped submittals and review comments and forward to NAC Architecture for distribution.
3. Architect fills out Part 3 and returns to Contractor.

Part 1

To NAC Architecture
2025 First Avenue, Suite 300
Seattle, WA 98121

Project WSH New Kitchen Commissary Pharmacy

Date

NAC No. 121 - 16004 - 10G

Owner Project No. 2016-410G (2-1)

Spec Section

Transmitted herewithin ☐ Shop Drawing ☐ Product Data ☐ Samples **Submittal No.**

Manufacturer **Subcontractor/Supplier**

Copies	Item Description (Drawing No., Date, Sample ID, etc.)

All statements are assumed to be affirmed (indicated by a check mark) when compared to the specified item, unless specifically indicated otherwise.

☐ 1. The submitted item is identical to the specified product with regard to: size constraints; performance characteristics and capacities; same options or accessories without cost change; certification and testing standards; mechanical/electrical/other service connections and load requirements; guarantees/warrantees; in all other aspects.

☐ 2. The submitted item is the same manufacturer and model number or an approved substitute in Addenda #

☐ 3. The submitted item has the same impacts on other trades.

☐ 4. The submitted item meets all applicable code requirements.

☐ 5. This submitted item is asbestos free.

☐ 6. The submitted item is identical in all ways.

If all statements are not affirmed, explain why. (Use Alt + Enter to create new lines.)

If a substitution is made, Contractor is responsible for all impacts the substitution has on the project. (Use Alt + Enter to create new lines.)

>1203 West Riverside Avenue, Spokane, WA 99201-1107
509 838 8240 / nacarchitecture.com
Seattle / Spokane / Los Angeles

013324-SubmittalShopDrawingTransmittal.xlsm

Submittal/Shop Drawing Transmittal

Part 2

To

From

Date Received by Consultant

Date Returned to Architect

Reviewed by

Remarks

Consultant

Recommended Action

Part 3

To **Contractor**

Date Received by Architect

Date Returned to Contractor

Action

- ☐ No Exception Taken
- ☐ Rejected
- ☐ See Consultants Comments
- ☐ Revise & Resubmit
- ☐ Note Markings on Drawing/Resubmission not Requested

Architects review is for general conformance with the design concept and Contract Documents. If any deviations from the Contract Documents are included herein, such deviations shall be presumed by the Contractor as not having been reviewed by the Architects, except where specific attention is called to the change as a deviation. Markings or comments shall not be construed as relieving the Contractor from compliance with the project plans and specifications. The Contractor is responsible for details and accuracy, confirming and correlating all quantities and dimensions, fabrication processes, and techniques of construction, coordination of this work with that of all trades and the satisfactory performance of this work.

Remarks (Use Alt + Enter to create new lines.)

Attached are copies / reproducible(s) for Contractor distribution to Subcontractor, supplier, Manufacturer or others as appropriate

Copied to

By

>2025 1st Avenue, Suite 300 Seattle, WA 98101
206 441 4522 / nacarchitecture.com
Seattle / Spokane / Los Angeles

SECTION 013553 – SPECIAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This procedure governs Contractor requirements and actions when at the facility(s) associated with this project. Compliance with the requirements set forth herein is a contract requirement, and additional compensation for same will not be allowed. Sub-sections Included in this Procedure:

1. Definitions.
2. Applications.
3. Background Checks and Identification Badges.
4. Emergency Contact Information.
5. Western State Hospital Contractor Policies.
6. Adjacent Roadways and Contractor Parking.
7. WSH Security.

1.3 DEFINITIONS

A. Contract Work: The scope of work as defined in the Project Documents.

B. Contractor: the entity whom is signatory to execute the Contract Work.

C. Superintendent: The person managing all aspects of the Contract Work on the site and at the location where the Contract Work is to be performed, and has authority to act as an Agent for the Contractor.

D. Contractor Personnel: Any individual person, employed directly or indirectly by the contractor to perform work or provide services in connection with the work of this Contract.

E. Owner: State of Washington, Department of Social and Health Services.

F. Owner Representative: The person(s) designated by the Owner for liaison with the contractor.

1.4 APPLICATIONS

A. These requirements apply to all Contract Work and Contractor Personnel related to the Contract Work

B. All Contractor Personnel shall be required to submit personal identifying information and be subjected to a background check prior to being granted access to the location where

the Contract Work is to be performed. Information required is as indicated on the attached "Background Authorization" form.

C. The Owner will issue identification badges to all contractor employees who pass the background check and have attended a campus security orientation class as outlined in Article 1.5 below. The badge will be worn on the outer clothing and in plain view at all times.

1.5 BACKGROUND CHECKS AND IDENTIFICATION BADGES

A. Only the Contractor Personnel with an approved background check that have been issued a WSH badge will be permitted on the campus.

1. At the Owners discretion, temporary badges may be issued for individuals related to the Contract Work that will be at the location of the Contractor Work only once for less than 8 hrs.
2. Individuals delivering materials related to the Contract Work will not be required to have WSH badges but must be received at the location of the Contract Work by the Contractors Superintendent, whom will be in their direct presence and supervision, and will be responsible for them until they leave the area of the Contract Work.
3. The project managers and superintendents for the General Contractor, Civil, Mechanical, Electrical and Framing/Sheathing subcontractors are required to complete a background check and compete a formal campus security orientation session (approximately 90 minutes in length) and obtain a WSH identification badge.
4. Other construction personnel must successfully complete and pass the aforementioned background check and obtain an identification badge prior to beginning work on the WSH Campus. The Owner will arrange for group orientations at the project site for these individuals. The Owner will work directly with the Contractor to conduct these group training sessions for construction personnel on a regular basis to facilitate background checks and badging of all construction personnel.

B. The Contractor will be responsible for submitting the DSHS "Background Authorization Form" and ensuring it is fully completed before submitting, for all Contractor Personnel utilizing the form following this section or a digital copy that can be obtain from the Owner Representative or by sending a request to: ocpbackgroundchecks@dshs.wa.gov.

C. The Contractor will allow at least (10) work days for fully completed Background Authorization Forms to be reviewed and badges issued, pending satisfactory determination is made.

1. After badges are ready to be issued, construction personnel shall attend a campus orientation class (class is approximately one-hour in length). The intent of the class is to provide those working on the campus with emergency procedures, instructions on how to interact with patients, and other pertinent information.

D. The information provided will be used to conduct a background investigation on each proposed Contractor Personnel. Determination of approval or denial of an application will be based on DSHS Administrative Policy No. 18.63. Additional consideration of a denial based on this policy, at request of the Contractor may be considered at the discretion of the Owner based on extenuating circumstances, and requirements of the facility and the project.

E. All completed Background Check Authorization forms to be submitted in PDF format to: ocpbackgroundchecks@dshs.wa.gov.

1.6 EMERGENCY CONTACT INFORMATION

A. In the case of an emergency situation that requires owner involvement contact information and sequence of contacts will be provided at the Pre-Construction Meeting.

1.7 WESTERN STATE HOSPITAL CONTRACTOR POLICIES

A. Identification Badges: All construction personnel will wear their Western State Hospital (WSH) identification badge while on hospital grounds in a visible manner (located at the front of the torso, at or above waist level) except when working within the construction perimeter. If a name badge is not immediately available, the employee must wear a temporary badge until a permanent badge is obtained. The photo must be visible at all times and remain unobstructed.

1. Report a missing badge to your supervisor and the Security Department immediately.

B. Tool Control: When working outside a secured construction area a physical inventory of tools shall be maintained to ensure that all tools are accounted for prior to entering and upon leaving the area where the work was performed.

1. Any contractor who determines that a tool is missing will immediately report the loss to their supervisor or project manager and the Security Department.

C. Prohibited Items and Substances: Bringing narcotics, intoxicating liquors, weapons, etc., into the institution or on its grounds is prohibited per RCW Chapter 9A.20.

D. Confidentiality: Other than authorized construction related photos, photography is prohibited on the campus.

1. When taking photographs ensure no patients or staff are visible.

E. Emergencies: In the event of an emergency, call (253) 756-2692. **DO NOT CALL 911** as emergency responders report to the main security center, where they will be directed to the scene of the incident.

1.8 ADJACENT ROADWAYS AND CONTRACTOR PARKING

A. Adjacent Roadways: Two-way traffic shall be maintained on the roadways on the south and east side of the project site (Sequoia Street and Circle Drive). Notify WSH three

weeks in advance of closures required for utility excavation, construction and connections.

1. The parking strip on the north side of Sequoia Street may be used for construction activities to the extent indicated on the Drawings.

B. Contractor Parking: Overflow parking for badged construction personnel can be accommodated at parking lot P-5, located at the northwest corner of the campus. A Contractor-provided shuttle to transport construction personnel is recommended but not required.

1.9 WSH SECURITY

A. To facilitate patient safety, and to provide security during non-construction hours, provide a space in a trailer located adjacent to the primary construction entrance for WSH security personnel. Coordinate location with the Architect and WSH staff. Space shall have power and heat. Telephone services are not required.

1. WSH security staff will visually inspect the site at the end of working hours to ensure tools have been adequately secured from patient access and/or theft.
2. WSH security will not staff this space on a 24/7 basis.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013553

ss: November 29, 2017

dj: Noveber 21, 2017

Washington State Department of Social & Health Services
Transforming lives

Background Check Authorization

PROCESSING CODE
Initial Contract : OCP

SECTION 1. ENTITY INFORMATION (COMPLETED BY DSHS STAFF, PROVIDER, APPLICANT, LICENSEE, AND/OR CONTRACTOR)

1A. ENTITY REQUESTING THE BACKGROUND CHECK	1B. ENTIRE ADDRESS OF ENTITY LISTED IN BOX 1A	1C. NAME OF SECONDARY ENTITY
DSHS OSSD **Office of Capital Programs**	**1115 Washington St. SE; MS: 45848** **Olympia, Washington 98504-5848**	**Contractor:** **Project #2016-410G (2-1)**

2. **REQUIRED:** NAME AND SIGNATURE OF PERSON REQUESTING THE BACKGROUND CHECK

PRINTED NAME: SIGNATURE:

3. **REQUIRED ONLY FOR DSHS STATE EMPLOYMENT**

DSHS POSITION NUMBER **NA** **(WRITE NONE IF NONE)** DSHS JOB CLASSIFICATION: _____ PERSONNEL IDENTIFICATION NUMBER: _____

☐ Permanent appointment ☐ Non-permanent appointment ☐ Work study / student internship ☐ Volunteer ☐ Acting

4. **REQUIRED:** BCCU ACCOUNT NUMBER	5. DSHS ID NUMBER OR NAME
11000391	**NA**

SECTION 2. THIS SECTION IS FOR APPLICANT INFORMATION ONLY (THE PERSON TO BE CHECKED IS THE APPLICANT)

6. SOCIAL SECURITY NUMBER	7. **REQUIRED:** DATE OF BIRTH (MM/DD/YYYY)	8. PRINT YOUR E-MAIL ADDRESS

9. **REQUIRED:** PRINT YOUR NAME AS IT IS LISTED ON YOUR DRIVER'S LICENSE OR OTHER PHOTO ID. WRITE N/A IN THE BOX IF YOU DON'T HAVE A NAME TO ENTER.

FIRST:	MIDDLE:	LAST:

10. **REQUIRED:** PRINT ALL OTHER FIRST, MIDDLE AND LAST NAMES YOU HAVE USED. WRITE N/A IN THE BOX IF YOU DON'T HAVE A NAME TO ENTER.

FIRST:	MIDDLE:	LAST:

REQUIRED: SELF DISCLOSURE QUESTIONS. SEE INSTRUCTIONS.

You must answer Questions 11A through 14. Attach an additional sheet of paper if you need to list additional crimes or pending charges.

11A. Have you been convicted of any crime? If yes, fill in the blanks below. ☐ Yes ☐ No

_____ Degree: _____ State: __ Conviction date: __/__/____

11B. Do you have charges (pending) against you for any crime? If yes, fill in the blanks below. ☐ Yes ☐ No

_____ Degree: _____ State: __

12. Has a court or state agency ever issued you an order or other final notification stating that you have sexually abused, physically abused, neglected, abandoned, or exploited a child, juvenile, or vulnerable adult? ☐ Yes ☐ No

13. Has a government agency ever denied, terminated, or revoked your contract or license for failing to care for children, juveniles, or vulnerable adults; or have you ever given up your contract or license because a government agency was taking action against you for failing to care for children, juveniles, or vulnerable adults? ☐ Yes ☐ No

14. Has a court ever entered any of the following against you for abuse, sexual abuse, neglect, abandonment, domestic violence, exploitation, or financial exploitation of a vulnerable adult, juvenile or child? ☐ Yes ☐ No

- Permanent* vulnerable adult protection order / restraining order, either active or expired, under RCW 74.34.
- Sexual assault protection order under RCW 7.90.
- Permanent* civil anti-harassment protection order, either active or expired, under RCW 10.14.
  See instructions for description of "permanent."

15. **REQUIRED:** PRINT YOUR DRIVER'S LICENSE OR STATE IDENTIFICATION NUMBER **(WRITE NONE IF NONE)**	**REQUIRED:** PRINT THE NAME OF THE STATE ON YOUR LICENSE OR ID

16. **REQUIRED**

Have you lived in any state or country other than Washington State within the last three years (36 months)? ☐ Yes ☐ No

17. **A. REQUIRED:** PRINT YOUR MAILING ADDRESS WHERE WE CAN SEND YOU CONFIDENTIAL INFORMATION

APT. NO. CITY STATE ZIP CODE

B. REQUIRED: PRINT THE STREET ADDRESS WHERE YOU LIVE NOW (WRITE "SAME" IF YOUR STREET ADDRESS IS THE SAME AS YOUR MAILING ADDRESS)

APT. NO. CITY STATE ZIP CODE

C. REQUIRED: GIVE THE DAYTIME AREA CODE AND TELEPHONE NUMBER WHERE YOU CAN BE REACHED

18. I am the person named above. If I do not tell the whole truth on this form, I understand I can be charged with perjury and I may not be allowed to work with vulnerable adults, juveniles or children. I understand and agree my signature in box number 19 means:

- I give DSHS permission to check my background with any governmental entity and law enforcement agency.
- My background check result may include prior self-disclosure information and fingerprint results that are contained in the DSHS Background Check System and that this information will be reported as allowed by federal or state law.
- If a final finding is identified, DSHS will report only my name and that a final finding was identified on the background check result.
- DSHS will give my background check result to the persons or entities named in Section 1 and may release my background check results to other persons or entities when the law authorizes or requires DSHS to do so. Fingerprint rap sheets are provided if allowed by federal or state law.
- The entity requesting this background check must submit this form to the Background Check Central Unit within the timeframe required by the DSHS oversight program.

19. **REQUIRED:** YOUR SIGNATURE. YOUR PARENT OR GUARDIAN'S SIGNATURE IF YOU ARE UNDER 18.	20. **REQUIRED:** TODAY'S DATE (MM/DD/YYYY)

PROGRAM USE – FOLLOW INSTRUCTIONS PROVIDED BY YOUR DSHS OVERSIGHT PROGRAM

Instructions for Completing the Background Check Authorization
DSHS 09-653

These instructions provide general directions for completing the Background Check Authorization form. This form is used by multiple DSHS programs to meet varying background check needs. **The DSHS oversight program requiring the background check may have additional instructions that you must follow.**

The Background Check Central Unit (BCCU) **cannot** complete the background check unless all required boxes are complete. Required boxes have the word **REQUIRED:** next to the box number as shown in the example below:

4. **REQUIRED:** BCCU ACCOUNT NUMBER

IMPORTANT: If you do not provide all required information, your background check will be delayed.

ATTENTION ENTITIES AND DSHS STAFF: Only submit this authorization form once. Multiple submissions of the same authorization form causes delays in processing background checks.

PROCESSING CODE: If you use a priority processing code or "fingerprint required", enter it in this box. Priority processing codes include new hire, initial contract, initial license, approved rush, Community Protection, and DSHS state employee.

SECTION 1: TO BE COMPLETED BY THE ENTITY REQUESTING THE BACKGROUND CHECK

This section must be completed by the **entity** requesting the background check. Entities are most often DSHS programs, hiring authorities, and external providers who submit background check requests to the Background Check Central Unit.

Box No.	Instructions
1A	Enter the name of the entity requesting the background check.
1B	Enter the full address of the entity listed in Box 1A.
1C	Enter the name of the secondary entity associated with the background check. A secondary entity may be a contractor, subcontractor, or other entity associated with this background check. Your oversight program will provide instructions on how to use this box.
2	Provide the printed name and signature of the person requesting the background check. This is the person who is submitting the background check on behalf of the entity listed in Box 1A.
3	Complete this box **ONLY** if the background check is for DSHS employment purposes. External providers should **not** complete this box.
4	Enter your BCCU account number in this box. You can find your BCCU account number at http://www.dshs.wa.gov/fsa/bccu/account-numbers. DSHS state employment account numbers are available on the BCCU intranet webpage.
5	Enter a DSHS ID number or name if required by your DSHS oversight program.

SECTION 2: TO BE COMPLETED BY THE APPLICANT

This section must be completed by the **applicant**. The applicant is the person whose background we are checking. Except as noted in these instructions, DSHS staff must not complete Section 2 for the applicant. Note: Adult Protective Services program staff may complete the applicant information for an APS investigation background check.

Box No.	Instructions
6	You may choose to provide your Social Security Number. Your Social Security Number helps the Background Check Central Unit match your name and date of birth to existing records in our database and may speed up completion of your background check.
7	Print your date of birth listing the month, day, and year.
8	Provide an e-mail address where we can reach you.
9	Current Name: List your first, middle, and last name as they are listed on your current Driver's License or other primary photo ID. (See example below.) Accepted government-issued photo ID includes any federal, state, or local government-issued ID, US military ID, US or foreign passport, or federally recognized tribal ID. Write **N/A** in each field that you do not have a name to enter.

9. **REQUIRED:** PRINT YOUR NAME AS IT IS ON YOUR DRIVER'S LICENSE OR OTHER PHOTO ID. WRITE N/A IN THE BOX IF YOU DON'T HAVE A NAME TO ENTER.		
FIRST: **Susan**	MIDDLE: **Jane**	LAST: **Smith**

10 Other Names: Print all other first, middle, or last names you have used. Other names include nicknames, birth names, maiden names, etc. If you have not used any other first, middle, or last names, you must enter **N/A** in the appropriate box. Do not leave any of the boxes blank. (See examples below)

Example 1 – entering two nicknames and one maiden name. No other middle names have been used.

10. **REQUIRED:** PRINT ALL OTHER FIRST, MIDDLE AND LAST NAMES YOU HAVE USED. WRITE N/A IN THE BOX IF YOU DON'T HAVE A NAME TO ENTER.		
FIRST: **Sue, Susie**	MIDDLE: **N/A**	LAST: **Jones**

Example 2 – entering N/A because no other first, middle, or last names have been used.

10. **REQUIRED:** PRINT ALL OTHER FIRST, MIDDLE AND LAST NAMES YOU HAVE USED. WRITE N/A IN THE BOX IF YOU DON'T HAVE A NAME TO ENTER.		
FIRST: N/A	MIDDLE: N/A	LAST: N/A

See important information about answering self-disclosure questions following the description for Box 20.

Box No. Instructions

11A You must check **YES** or **NO.** If you check **YES**, you must enter the crime name, degree (if any), state, and the conviction date (MM/DD/YYYY). If you need to list additional convictions, attach a separate piece of paper to the Background Check Authorization form. Include your name and all the required information listed above.

11B You must check **YES** or **NO.** If you check **YES**, you must enter the pending charge name, degree (if any), and state. If you need to list additional pending charges, attach a separate piece of paper to the Background Check Authorization form. Include your name and all the required information listed above.

12-14 Read each question carefully before answering. You must check YES or NO. ***Question 14: Permanent means the order was issued either following a hearing or by stipulation of the parties.**

15 Enter your Driver's License or state-issued ID and the state where it was issued.

16 If you have continuously lived in Washington State without living in another state or country for the last three years (36 months), answer **NO**. If you have lived in any state or country other than Washington State within the last three years (36 months), answer **YES**.

17 17a - Enter your mailing address where BCCU can send you confidential information such as a copy of your background check results.

17b – Enter your street address if it is different than your mailing address. If your street address and mailing address are the same, enter **SAME**.

17c – Enter the daytime phone number where you can be reached.

18. Read the statements in Box 18. Your signature in Box 19 means you have read, understand, and agree to the statements listed in Box 18.

19. Sign your name as it is listed in Box 9. If you are not 18 years old, a parent or guardian must sign for you.

20. Enter the month / day / year (MM/DD/YYYY) you signed Box 19.

IMPORTANT INFORMATION ABOUT ANSWERING SELF-DISCLOSURE QUESTIONS: Your answers to self-disclosure questions become part of your background check history and are stored in the DSHS database. Self-disclosures are reported as part of your background check result like any other background check history we receive. It is important that your answers to self-disclosure questions are accurate and consistent. It is strongly recommended that you answer self-disclosure questions the same way each time you complete the Background Check Authorization form unless the question has changed or the previous answer was wrong. It is also recommended that you refer to charging papers, court records, or other official documents and that you list criminal convictions, pending charges, dates and other information exactly as they are listed in those documents.

If you have questions about the Background Check Central Unit background check process, contact BCCU at bccuinquiry@dshs.wa.gov or call 360-902-7555.

STATE OF WASHINGTON
Department of Social and Health Services
Western State Hospital

Contractor Badging & Key Issuance Guidelines

Step #1, Background Check and Clearance

1. Contact the Capitol Programs Manager assigned to your project, they will provide guidance on how to submit background checks and who to submit them to.
2. Once you have received electronic confirmation via email that background checks have cleared, proceed to step #2.

NOTE: Retain the electronic confirmation as you may be asked to provide it during steps 2 and/or 3, the date of clearance will be needed.

Step #2, Request for WSH Contractor Badge

1. Take head shot picture of each person(s) needing a badge, headshot picture should extend roughly 1-2" above the head to the upper torso. Each picture needs to be titled with the employee's first name, last name, company name and the date they cleared the background check.

   (Example: John Doe_Company Name_Cleared 00/00/2016)

2. Send the headshot picture(s) to both email addresses and title the email as shown below:

   Title of Email (subject line):
   Contractor Badge Request_"Insert Your Company Name"_Date of Request

   Send To:
   Jerilee Brixey
   Email: brixeje@dshs.wa.gov Telephone: 253.756.2328
   WSH Badging Office
   wshbadgerequest@dshs.wa.gov

3. Once the above steps are completed, proceed to step #3, WSH badges will only be issued upon completion of the site safety orientation.

Step #3, Schedule WSH Site Safety Contractor Orientation

1. Send an email to the WSH Training Department requesting contractor training; the body of the email needs to contain a bulleted list of names (first and last) with the employee(s) corresponding company name.

   Title of Email (subject line)
   Contractor Training Request_"Insert Your Company Name"_Date of Request_State Project Number

   Send To
   Daniel Gapsch:
   Email: GAPSCDJ@dshs.wa.gov Telephone: 253.756.2782
   Christie Smythe:
   Email: SMYTHCM@dshs.wa.gov Telephone: 253.761.7656

2. You will be given a date and time to attend the safety orientation, upon completion of the safety orientation badges will be distributed. You will need to present a valid driver's license or approved, state issued photo I.D. to receive the WSH ID badge at the end of class.

   If badges are not ready for distribution by the end of the safety orientation class, contact Jerilee Brixey to arrange a date/time to pick up the badges.

NOTE: If step 1 has not been completed and the employee has not been cleared, badges will not be issued or created.

Step #4, Key Issuance

1. Contractors with an approved WSH photo badge containing an expiration date that is with-in the badges expiration period can freely check out the following keys:

   Contractor Keys
   - LL805 (Fire Extinguisher Box & Pull Station Key)
   - WW1 (Common Interior Egress and Ingress)
   - CT1 (Common Central Campus Exterior Egress Key)
   - CT2 (Common East Campus Exterior Egress Key)
   - MR1 (Maintenance Key)
   - MR1A (Maintenance Key)

2. Contractors needing access to restricted locations containing key cores not listed in step #4, line #1 will need to contact the Facility Coordination Office. Each key core on each door is stamped with a number; this number will need to be provided at the time of request.

Facility Coordination Office

Christine Campbell, Facilities Coordination Manager
Email: CAMPBCHL@dshs.wa.gov Office: 253.879.7920
Joey Roberts, Facilities Planner 2
Email: ROBERJR@dshs.wa.gov Office: 253.512.5449 Cell: 253.442.4182

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 CONTRACTOR'S QUALITY CONTROL PLAN

A. General:

1. The Contractor shall establish a Quality Control Plan to identify, perform and record sufficient inspection and tests of all items of work, including that of subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. The Contractor shall:

   a. Perform all quality control tests as required by local law if more stringent than specific requirements of these Specifications,
   b. Establish this control for all construction except where the Contract Documents provide for specific compliance tests by testing laboratories or engineers employed by the Owner, in which case the Contractor shall be responsible for the coordination of such testing with the Work of the Contract, and,
   c. Provide assurance that all preparatory work performed under the Contract meets or exceeds required level of quality. Contractor's control system shall specifically include all testing required by the various sections of the Specifications.

B. The Contractor shall designate a Contract Quality Control (CQC) Plan Administrator whose responsibility shall be the overall administration of the Plan as defined therein. The Administrator shall sign all reports, logs and other documents/forms related to the Plan, and in so doing shall certify the accuracy and completeness of the information contained therein.

C. Records:

1. Maintain on-site Quality Control Plan Records, organized by specification section, on appropriate forms for all inspections and tests performed. Maintain records of instructions received from the Architect and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed and their results (including type and number of inspections or tests, nature of defects, causes for rejection, etc.) proposed or directed remedial action, and corrective actions taken. Document inspections and tests as required by each section of the specifications. Quality Control Plan Records shall be readily available for review by the Owner and Architect.

D. Quality Control Plan:

1. Within ten (10) days of Notice of Award, furnish to Architect, with proposed Schedule of Values, a Quality Control Plan that shall include resumes of the Plan Administrator, Superintendent, Project Engineer and Project Manager, their specific Plan duties and responsibilities, as well as procedures, instructions, and records to be used. The Plan shall specifically include the following:

a. A list of control tests that the Contractor is to perform, or his subcontractors are to perform, under his coordination. Control tests shall be listed by Specification Section.
b. Contractor's surveyor.
c. Procedures for reviewing all Shop Drawings, Product Data, samples or other submittals before submission to Architect. Include procedures for obtaining required field measurements.
d. Method of documenting quality control operation, inspection, and testing including samples of proposed forms, logs, and daily reports.
e. Quality control activities schedule.

1.3 COORDINATION WITH OTHER ENTITIES

A. Cooperate with other entities performing quality control activities.

B. Provide samples of materials and design criteria as indicated and when requested.

C. Provide other assistance, equipment, tools, and storage facilities as specified.

D. Make arrangements with those entities and pay for additional, similar or related testing or inspection required for the Contractor's use or convenience.

E. Coordinate quality control activities to avoid delay and to avoid the necessity of removing and replacing construction to accommodate testing and inspections.

F. Notify the Owner's testing agencies fourteen (14) working days prior to anticipated commencement or completion of work which is to be tested or inspected, whichever is applicable (initial notification).

1.4 CONTRACTOR'S PRE-INSTALLATION QUALITY CONTROL

A. Coordination of Work:

1. Well in advance of the installation of every major unit of work which requires coordination with other work, the Contractor shall ensure that the unit of work can be installed and function as intended and required in conjunction with other work which has preceded or will follow. In the event of discrepancies or conflicts, the Contractor shall propose written resolutions, inform the Architect, and proceed with Architect's concurrence.

B. Pre-installation Meetings:

1. Contractor shall schedule, set agenda and conduct pre-installation meetings as required or necessary to assure quality control, and to confirm responsibilities of various parties. Contractor shall record minutes of meetings and distribute to attendees and other parties as deemed appropriate. Contractor shall notify Owner and Architect of all pre-installation meetings a minimum fourteen (14) days prior to scheduled meeting. Owner and Architect may attend Meetings.

C. Inspection of Conditions:

1. The Contractor shall require the installer of each major unit of work to (1) inspect the substrate to receive the work, (2) inspect the conditions under which the work will be performed, and (3) report in writing to the Contractor that the substrate(s) and conditions are either satisfactory or unsatisfactory. The installer shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to him, completion of corrections has been reported in writing to the Contractor, and Contractor has distributed same to Architect and Owner. Copies of written notifications shall be maintained in Contractor’s field office, incorporated into the Quality Control Plan Records, organized by Specification Section.

D. Notice for Owner's Testing Lab:

1. The Contractor shall notify the Owner's testing laboratory, the civil engineer, and the Architect not less than 24 hours before work requiring inspection or testing is started (confirming notification).

1.5 CONTRACTOR'S INSTALLATION QUALITY CONTROL

A. Manufacturer's Instructions:

1. The Contractor shall comply with the Manufacturer's applicable instructions and recommendations for installation. To whatever extent these are more explicit or more stringent than Contract Document requirements, indicate in the Record Documents.

B. Inspection:

1. The Contractor shall inspect each item of material or equipment immediately upon delivery and immediately preceding installation. Contractor shall reject damaged or defective items.

C. Attachments and Connections:

1. Provide attachment and connection devices and methods for securing work properly as it is installed, true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions, building movements, and staff activity. Provide uniform joint widths in exposed work, organized for

best possible visual effect. Refer questionable visual effect choices to Architect for final decision.

D. Verify Dimensions:

1. Recheck measurements and dimensions of the work as an integral step of starting each installation. Maintain written record of confirmation of satisfactory findings, or describe unsatisfactory conditions and proposed resolution. Maintain written records of unsatisfactory conditions and resolutions when required.

E. Conditions for the Work:

1. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion that will ensure the best possible result for each unit of work in coordination with the entire work. Isolate each unit of work from non-compatible work as required to prevent deterioration. Maintain documentation attesting to same.

1.6 FIELD ENGINEERING

A. The Contractor shall employ a professional engineer or land surveyor registered in the State of Washington and acceptable to the Owner and Architect.

B. Engineer or surveyor shall be responsible for location of major site elements, installation of control stakes as required and final certification that finish grading has been completed within the tolerances specified. Coordinate all other field engineering of applicable subcontractors.

C. Documentation and Records: Surveyor or engineer shall maintain a complete and accurate log of control and survey work as it progresses. On request of the Architect, submit documentation to verify accuracy of field engineering work.

1.7 PROJECT SURVEY REQUIREMENTS

A. Reference Points: Immediately upon entering the project, locate and maintain bench marks and all other grades, lines, levels and dimensions. Report any errors or inconsistencies to the Architect before commencing work.

B. Permanent Bench Marks: The surveyor or engineer shall establish a minimum of two permanent bench marks on the site, referenced to data established by survey control points.

C. Preservation of Monuments and Stakes: Carefully preserve all monuments, bench marks, property markers, reference points, and stakes. In case of the destruction of these, the Contractor will be charged with expense of replacement and shall be responsible for any mistake, loss of time or additional expense that may be caused. Protect permanent monuments or bench marks that must be removed or disturbed until properly referenced for relocation. Furnish materials and assistance for proper replacement of such monuments or bench marks.

D. Layout and Control: The surveyor or engineer shall establish lines and levels, locate and layout by instrumentation and similar means stakes for finish grading. He shall set control stakes and shall reset stakes as required during progress of the work. The surveyor or engineer shall provide the Architect with a shop drawing showing all new paved areas on the site with all radii, radii points, angles, segment lengths, and clearance dimensions called out and drawn to same scale as site plan. Paved areas shall include asphalt, concrete, curbs, and special surfaces.

E. Completion: Upon completion of the work, the surveyor or engineer shall survey the site to verify that locations and elevations required by the Contract Documents have been achieved within the specified tolerances.

1. Submit to Owner a certificate signed by the surveyor or engineer certifying that elevations and locations are in conformance with the Contract Documents.
2. Submit to Owner complete record "As-Built" Survey and Utility Plans, in both hard copy and electronic format.

F. Refer to General Conditions for additional requirements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014000

dj: October 5, 2017

SECTION 014100 –ENVELOPE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes: This section includes administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air.

1. The airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure are called “the air barrier system”. Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
2. The Contractor shall ensure that the intent of constructing the building enclosure with a continuous air barrier system to control air leakage into, or out of the conditioned space is achieved. The air barrier system shall have the following characteristics:

    a. It must be continuous, with all joints sealed.
    b. It must be structurally supported to withstand positive and negative air pressures applied to the building enclosure.
    c. Connection shall be made between:

        1) Foundation and walls.
        2) Walls and windows or doors.
        3) Different wall systems.
        4) Wall and roof.
        5) Wall and roof over unconditioned space.
        6) Walls, floor and roof across construction, control and expansion joints.
        7) Walls, floors and roof to utility, pipe and duct penetrations.

3. Air Barrier Penetrations: All penetrations of the air barrier and paths of air infiltration / exfiltration shall be sealed.

B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

C. Requirements of this section relate to the coordination between subcontractors required to provide an airtight building enclosure, customized fabrication and installation procedures, not production of standard products.

1. Continuity of the air barrier materials and products with joints to provide assemblies. Continuity of all the enclosure assemblies with joints and transition materials to provide a whole building air barrier system.
2. Specific quality-control requirements for individual construction activities are specified in the sections of the specifications. Requirements in those sections may also cover production of standard products. It is the Contractor's responsibility to ensure that each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each section.
3. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
4. Requirements for Contractor to provide an airtight building enclosure is not limited by quality-control services required by Architect, Owner, or authorities having jurisdiction and are not limited by provisions of this section.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide coordination of the trades, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof. Provide quality assurance procedures, testing and verification as specified herein. Facilitate inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner. Costs for these services are included in the Contract Sum.

1. Organize preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.
2. Build a mock-up before proceeding with the work, satisfactory to the Architect, of each air-tight joint type, juncture, and transition between products, materials and assemblies.

B. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Deliver samples to testing laboratories.
5. Provide security and protection of samples and test equipment at the Project Site.

C. Duties of the Testing and Inspection Agency: The independent agency engaged to perform inspections, sampling, and testing of air barrier materials, components and

assemblies specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

D. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 PERFORMANCE REQUIREMENTS

A. Compliance Alternatives:

1. Materials: Materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178. Or;
2. Assemblies of materials and components: shall have an air permeance not to exceed 0.04 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.2 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2357. Or;
3. The entire building: The air leakage of the entire building shall not exceed 0.4 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (2.0 L/s.m2 @ 75 Pa) when tested according to ASTM E 779.

B. Building Envelope Testing and Reports:

1. Comply with requirements per WSEC C402.4.1.2.3 Building Test for testing of the completed building envelope in accordance with ASTM E 779 or an equivalent method approved by the Code Official. Unless the Contractor is providing this service, an independent testing agency shall perform the envelope testing and submit certified written reports to the Owner, Architect, Contractor, and Code Official. The report must include at a minimum the tested surface area, floor area, air by volume, stories above grade, and the air leakage rates. If the tested rate exceeds that defined per WSEC C402.1.2.3, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practical. An additional report identifying the corrective actions taken by the Contractor to seal air leaks shall be submitted to the Owner, Architect, independent testing agency, and Code Official.

SUBMITTALS

C. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:

a. Date of issue.
b. Project title and number.
c. Name, address, and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample taking and testing.
k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualifications for Air Barrier Testing and Inspection Agencies: Engage air Barrier inspection and testing service agencies, including independent testing laboratories, that are prequalified and that specialize in the types of air barrier system inspections and tests to be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

3.2 TESTING AND INSPECTION

A. The Owner will hire a testing and inspection agency to provide observation and inspection during installation of the air barrier system. The testing and inspection agency will provide the following listed services:

1. Qualitative Testing and Inspection:

a. Daily reports of observations, with copies to the Owner, Contractor and Architect.
b. Continuity of the air barrier system throughout the building enclosure with no gaps, holes.
c. Structural support of the air barrier system to withstand design air pressures.
d. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings.
e. Site conditions for application temperature and dryness of substrates.
f. Maximum length of exposure time of materials to ultra-violet deterioration.
g. Surfaces are properly primed.
h. Laps in material are 2”minimum, shingled in the correct direction (or mastic applied on exposed edges), with no fish-mouths.
i. Mastic applied on cut edges.
j. Roller has been used to enhance adhesion.
k. Measure application thickness of liquid-applied materials to manufacturer’s specifications for the specific substrate.
l. Materials used for compatibility.
m. Transitions at changes in direction, and structural support at gaps.
n. Connections between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
o. All penetrations sealed.
p. ASTM E 1186 “Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.”

1) Infrared scanning with pressurization/depressurization.
2) Smoke pencil with pressurization/depressurization.
3) Pressurization/depressurization with use of anemometer.
4) Generated sound with sound detection.
5) Tracer gas measurement of decay rate.
6) Chamber pressurization/depressurization in conjunction with smoke tracers.
7) Chamber depressurization using detection liquids.

2. Quantitative tests:

a. Provide written test reports of all tests performed, with copies to the Owner, Contractor and Architect.
b. Material compliance for maximum air permeance, ASTM E 2178.

c. ASTM E 283, Determining rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
d. Assemblies, ASTM E 2357, test pressure and allowable air leakage rate to be determined by design professional for interior design conditions and location of project.
e. CAN/CGSB 1986 Standard 149.10, Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method.
f. CAN/CGSB 1996 Standard 149.15 Determination of the Overall Envelope Airtightness of Office Buildings by the Fan Depressurization Method Using the Building's Air Handling System.
g. Whole building, floors, or suites, ASTM E779, Determining Airtightness of Buildings Air Leakage Rate by Single Zone Air Pressurization.
h. Windows and connections to adjacent opaque assemblies, ASTM E783 method B.
i. Tracer gas testing, ASTM E741.
j. Pressure test, ASTM E330.
k. Bond to substrate, ASTM D4541.

END OF SECTION 014100

dj: October 5, 2017

SECTION 014150 – AIR BARRIER SYSTEM QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for providing an airtight building enclosure that controls infiltration and exfiltration of air and requirements for testing of building air tightness.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

1.4 DEFINITIONS

A. Air Barrier System:

1. An air barrier system is a continuous assembly of interconnected components within the exterior enclosure of a building which prevents air flow across the assembly, caused by air pressure differential from one side of the assembly to the other.
2. The air barrier system components of the building shall generally consist of the following:

a. Concrete foundation walls.
b. Membrane air barrier systems applied over sheathing.
c. Closed windows and doors.
d. Roof membrane vapor retarder.
e. Membranes and seals connecting air barrier system elements.
f. Seals around penetrations in the air barrier system elements.

1.5 SYSTEM DESCRIPTION

A. Provide building enclosure with continuous air barrier systems to control air leakage into or out of the conditioned spaces to meet the specified performance requirements.

B. The air barrier system shall have the following characteristics:

1. It must be continuous, with all joints sealed.
2. It must be structurally supported to withstand positive and negative air pressures applied to the building enclosure.
3. Connection shall be made between:

a. Foundation and walls.
b. Wall air barrier system assemblies and windows or door assemblies.
c. Different wall systems, including the connection of the liquid air barrier membrane applied over the gypsum sheathing systems and the liquid air barrier system applied to the backside of the precast concrete.
d. Roof vapor retarder.
e. Wall, floor, and roof assemblies at construction, control and expansion joints.
f. Wall, floor, and roof air barrier system assemblies to utility, pipe and duct penetrations.

4. Air Barrier Penetrations: All penetrations of the air barrier and paths of air infiltration / exfiltration shall be sealed.

C. Overall Building Envelope Performance Requirement: The air leakage of the entire building shall not exceed 0.4 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (2.0 L/s.m2 @ 75 Pa) when tested according to ASTM E 779.

1.6 SUBMITTALS

A. Make submittals in accordance with Division 01 Section "Submittal Procedures."

B. Assigned Staff: Submit the name of the staff members assigned to verify the air barrier systems and description of past work experience which qualifies them for the specified duties.

1.7 QUALITY ASSURANCE

A. Air Barrier system Pre-Installation Conference:

1. Administer a pre-installation conference in accordance with Division 01 Section "Project Meetings."
2. Attendees: Architect, Envelope Consultant, Contractor, and all subcontractors installing air barrier system elements, including the following:

a. Sealant subcontractor.
b. Roofing subcontractors.
c. Flashing and sheet metal subcontractor.
d. Window and door installers.
e. Envelope consultant.

3. Discuss air barrier system components and sequence of installation.
4. Discuss all joints and penetrations and proposed methods for sealing.
5. Identify and discuss all special conditions.
6. Discuss exterior mock-ups.
7. Discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.

8. Discuss testing requirements, including potential for testing in limited portions of the building.

B. Assigned Contractor Staff: Assign a staff member, and at least one alternate, to be responsible for verifying that air barrier system components have been properly installed and that the area is ready for cover. Selected staff members shall have had experience in envelope construction.

C. Mock Ups: Where mock-ups are required for exterior envelope components; incorporate mock-ups of air barrier systems to verify an air tight seal.

1. Provide mockups for all exterior wall assembly types as indicated on the Drawings that provide exterior-to-interior envelope protection with a minimum area of 160 square feet including all windows and trim. Wall types that are indicated to provide exterior-to-exterior exposure are not required to be tested.
2. *In place mockups that remain part of the construction are acceptable. (Addendum 2)*

D. On-site Inspection:

1. The air barrier system is subject to inspection by the Project Envelope Consultant.
2. Provide a minimum of 48 hours notice prior to covering any air barrier system assembly.

1.8 CONTRACTOR RESPONSIBILITIES

A. Coordinate and sequence the Work as necessary to ensure the final continuity of the air barrier system, including joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof.

B. Provide quality assurance procedures and verifications as specified herein.

C. Ensure the following:

1. The air barrier system is continuous without gaps or holes.
2. Air barrier system membranes are structurally supported to withstand design air pressures.
3. Site conditions have been maintained for the application of air barrier system materials.
4. Surfaces to receive membranes have been properly cleaned and primed.
5. Laps in self-adhered membranes are 2”minimum, lapped to weather (or mastic sealed on exposed edges), with no fish-mouths.
6. Self-adhered and liquid applied membranes are properly bonded.
7. Thickness of liquid-applied materials meet manufacturer’s specifications.

D. Associated Services:

1. Cooperate with agencies performing required inspections, tests, and similar services, and provide auxiliary services as requested.
2. Provide access to the Work.

3. Furnish temporary construction and incidental labor and facilities necessary to support inspection and testing operations.
4. Provide security and protection of assemblies and test equipment at the Project Site.

E. Coordination:

1. Coordinate the sequence of activities to accommodate required services with a minimum of delay.
2. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
3. Schedule times for inspections, tests, sample taking, and similar activities.

F. If testing shows that the building does not meet the specified overall building envelope air barrier system performance requirements, perform repair and reconstruction of the envelope assemblies as necessary to meet the specified performance requirements as approved by the Architect. Additional tests required to verify performance after repair and reconstruction shall be paid for by the Contractor without additional charge to the Owner.

1.9 FIELD TESTING

A. The Owner may hire an independent testing agency to perform testing to verify that the building meets the specified air barrier system performance requirements.

B. Qualifications for Air Barrier System Testing Agency: Independent air barrier system testing agency that specializes in and has the equipment for the types of air barrier system tests to be performed.

C. The testing laboratory will be authorized to perform the following:

1. Submit a certified written report to the Architect, Owner's Representative, Envelope Consultant, and the Contractor after each testing operation.
2. Written reports may include, without limitation, the following:

a. Date of issue.
b. Project title and number.
c. Name, address, and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample taking and testing.
k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.

3. Duties of Testing and Inspection Agency:

a. Provide qualified personnel to perform required inspections and tests.
b. Coordinate with the Contractor as necessary to develop an effective air barrier system testing program for the Project.
c. Notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
d. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
e. The agency may not perform any duties of the Contractor.

D. Full Envelope Testing:

1. The testing agency will test the completed building envelope air barrier system in accordance with the requirements of ASTM E779.
2. Provide all equipment and construction as necessary to perform the tests.
3. Make corrections and repairs to the building envelope and retest in accordance with the requirements of ASTM E779 until the building envelope meets the performance requirements specified.

1.10 REPAIR AND PROTECTION

A. Upon completion of testing operations, repair damaged construction and restore substrates and finishes. Comply with requirements for Cutting and Patching described in Division One.
B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
C. Repair and protection is the Contractor’s responsibility.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014150

SECTION 014200 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term “indicated” refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specification, and similar requirements in the Contract Documents. Where terms such as “shown,” “noted,” “scheduled” and “specified” are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as “directed,” “requested,” “authorized,” “selected,” “approved,” “requested” and “permitted” mean “directed by the Architect,” “requested by the Architect,” and similar phrases.

D. Approve: The term “approved,” where used in conjunction with the Architect’s action on the Contractor’s submittals, applications and requests, is limited to the Architect’s duties and responsibilities as stated in the General Conditions of the Contract.

E. Regulation: The term “regulations” includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work.

F. Furnish: The term “furnish” is used to mean “supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.”

G. Install: The term “install” is used to describe operations at project site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”

H. Provide: The term “provide” means “to furnish and install, complete and ready for the intended use.”

I. Installer: An “installer” is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term “experienced”, when used with the term “Installer”, means having a minimum of ten(10) previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied requirements of the authority having jurisdiction.

2. Trades: Use of titles such as "carpentry" is not intend to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. Testing laboratories: A "testing laboratory" is an independent entity engage to perform specific inspections or tests, either at the project Site or elsewhere, and to report on and, if require, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specifications Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Word that are implied, but not stated shall be interpreted as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the contract Documents so indicates.
2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

a. The words "shall be" shall be included by inference wherever a colon (;) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standard in effect as of the date of the Contact Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, the standards may establish different or conflicting requirements for minimum quantities or quality levels, the more stringent requirements shall apply. Refer requirements that are different but apparently equal, and all uncertainties to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
2. Without specific written guidance from the Architect, the Contractor should always assume the highest quality and/or quantity shall be provided.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as f date of Contract Documents.

AA
Aluminum Association
900 19th St., NW, Suite 300
Washington, DC 20006 (202) 862-5100

ACI
American Concrete Institute
P.O. Box 19150
Detroit, MI 48219 (313) 532-2600

ACIL
American Council of Independent Laboratories
1725 K St., NW
Washington, DC 20006 (202) 887-5872

AIA
American Institute of Architects
1735 New York Ave., NW
Washington, DC 20006 (202) 626-7300

AISC
American Institute of Steel Construction
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001 (312) 672-2400

AISI
American Iron and Steel Institute
1133 Fifteenth St., NW
Washington, DC 20005 (202) 452-7100

AITC
American Institute of Timber Construction
11818 E. Mill Plain Blvd.
Vancouver, WA 98684 (206) 254-9132

ALSC
American Lumber Standards Committee
P.O. Box 210
Germantown, MD 20874 (301) 972-1700

ANSI
American National Standards Institute
1430 Broadway
New York, NY 10018 (212) 354-3300

AP
American Plywood Assoc.
P.O. Box 11700
Tacoma, WA 98411 (206) 565-6600

ARMA
Asphalt Roofing Manufacturers Assoc.
6288 Montrose Rd.
Rockville, MD 20852 (301) 231-9050

ASC
Adhesive and Sealant Council
1627 K Street, NW, Suite 1000
Washington DC 20006 (202) 452-1500

ASTM
American Society for Testing and Materials
1916 Race St.
Philadelphia, PA 19103 (215) 299-5400

AWPA
American Wood Preservers' Assoc.
P.O. Box 849
Stevensville, MD 21666 (301) 643-4163

CISPI
Cast Iron Soil Pipe Institute
5959 Shallowford Road, Suite 419
Chattanooga, TN 37421 (615) 892-0137

FM
Factory Mutual Research Organization
1151 Boston-Providence Turnpike
Norwood, MA 02062 (617) 672-4300

MCAA
Mechanical Contractors Association of American
1385 Piccard Dr.
Rockville, MD 20832 (301) 869-5800

NAPA
National Asphalt Pavement Assoc.
Calvert Building, Suite 620
6811 Kenilworth Ave.
Riverdale, MD 20737 (301) 779-4880

NEC
National Electric Code (from NFPA)

NECA
National Electrical Contractors Assoc.
7315 Wisconsin Ave.
Bethesda, MD 20814 (301) 657-3110

NEMA
National Electrical Manufacturers Assoc.
2101 L. St., NW, suite 300
Washington, DC 20037 (202) 457-8400

NFPA
National Fire Protection Assoc.
P.O. Box 9101
Quincy, MA 02269-9101 (617) 770-3000

N.F.P.A.
National Forest Products Assoc.
1250 Connecticut Ave., NW, Suite 200
Washington, DC 20037 (202) 463-2700

NLGA
National Lumber Grades Authority
1055 W. Hastings St., Suite 260
Vancouver, BC Canada V6E 2E9 (604) 687-2171

NPCA
National Paint and Coatings Assoc.
1500 Rhode Island Ave., NW
Washington, DC 20005 (202) 462-6272

NRCA
National Roofing Contractors Assoc.
One O'Hare Centre
6250 River Road, Suite 8030
Rosemont, IL 60018 (708) 318-6722

PDI
Plumbing and Drainage Institute c/o Sol Baker
1106 W. 77th St., South Dr.
Indianapolis, IN 46260 (317) 251-6970

SDI
Steel Deck Institute
P.O. Box 9506
Canton, OH 44711 (216) 493-7886

SJI
Steel Joist Institute
1205 48th Ave. N., Suite A
Myrtle Beach, SC 29577 (803) 449-0487

SMACNA
Sheet Metal and Air Conditioning Contractors National Assoc.
P.O. Box 70
Merrifield, VA 22116 (703) 790-9890

SPRI
Single Ply Roofing Institute
104 Wilmot Rd., Suite 201
Deerfield, IL 60015 (708) 940-8800

TIMA
Thermal Insulation Manufacturers Assoc.
29 Bank Street
Stanford, CT 06901 (203) 324-7533

UL
Underwriters Laboratories
333 Pfingsten Rd.
Northbrook, IL 60062 (708) 272-8800

WCLIB
West Coast Lumber Inspection Bureau
P.O. Box 23145
Portland, OR 97223 (503) 639-0651

WWPA
Western Wood Products Assoc.
522 SW 5th Ave.
Portland, OR 97204-2122 (503) 224-3930

F. Federal Government Agencies: Names and titles of federal government standard or Specification producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

CFR
Code of Federal Regulations
Available from the Government Printing Office
N. Capitol St. between G and H St. NW
Washington, DC 20402 (202) 783-3238

EPA
Environmental Protection Agency
401 M St. SW
Washington, DC 20460 (202) 382-2090

FS
Federal Specification (from GSA)
Specifications Unit (WFSIS)
7th and D St., SW (202) 472-2205
Washington, DC 20406 or (202) 472-2140

GSA
General Services Administration
F St. and 18th St., NW
Washington, DC 20405 (202) 472-1082

MIL
Military Standardization Documents
(U.S. Dept. of Defense)
Naval Publications and Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120

OSHA
Occupational Safety and Health Admin.
(U.S. Department of Labor)
Government Printing Office
Washington, DC 20402 (202) 523-6091

1.5 GOVERNING REGULATIONS/AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and discussions having a bearing on the work.

1.6 SUBMITTALS

A. Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014200

SECTION 014500 - EQUILIBRIUM OF RELATIVE HUMIDITY OF CONCRETE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES

A. Provide independent ERHC testing and pH testing to all cast in place concrete specified to be covered with floor coverings or resinous coatings. Includes concrete placed below, on and above grade. Contractor shall coordinate his work to cooperate with the requirement for and schedule of independent testing of concrete at described herein.

B. Testing shall take place after allowing concrete to dry for a minimum of 45 days. Testing to be scheduled to begin no less than eight weeks prior to the anticipated start of finished-flooring installation. Testing dates shall be included as a critical path item in the project CPM schedule.

1.3 REFERENCES

A. ASTM F-2170-09 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using ***in-situ*** Probes

B. ASTM F-710-08 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.4 SUBMITTALS

A. Report all test results in chart form listing the manufacturer and model of testing meter used to monitor test sites including serial number, last calibration date and type, test start date, test monitoring date, test location and number, depth of each test site, ERHC reading at each site, concrete internal temperature reading at each site, the concrete surface temperature at each site, the concrete surface pH level at each site, a visual description of the concrete surface at each site (i.e. light trowel, hard trowel, burnished, rain-out, etc.).

B. List test locations on chart and indicate the same on 8 ½ x 11 site map or printed floor-plan (when such map is made available to testing agency).

C. Results will be furnished to the Owner, Architect, Contractor and Flooring Subcontractor.

1.5 QUALITY ASSURANCE

A. Independent Testing Agency:

1. FLOORinSPEC, Inc.
   2020 Maltby Road PMB 114
   Bothell, WA 98021
   206-793-6720
2. Or firm certified by recognized industry training agency.

B. Relative Humidity Meters:

1. Commercially produced thermo-hygrometer specifically for use with ASTM F-2170-09 type testing, and meeting all requirements of ASTM F-2170-09 section 6.1
2. Must have verifiable calibration of instrument or sensor tip per the manufacturer's instructions (NIST traceable certification preferable).
3. Metering device and probes must comply with ASTM standards of size, sensitivity and calibration.

C. C. Monitoring pH:

1. Wide range pH paper, and distilled or de-ionized water.
2. Commercially manufactured pH meter for surface testing pH on top of solid and semi-solid materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Thermo-Hygrometers such as those manufactured by Lignomat, Delmhorst, Tramex, GE Protimeter or Vaisala Corporations; other meters must be approved prior to use.

B. Wide Range pH test paper as manufactured by Micro Essential Laboratory, or equal.

C. Commercial pH meters as manufactured by Extech; other meters must be approved prior to use.

PART 3 - EXECUTION

3.1 QUANTIFICATION OF EQUILIBRIUM RELATIVE HUMIDITY OF CONCRETE

A. Conditioning: Concrete floor slabs shall be at service temperature and the occupied air space above the floor slab shall be at service temperature and service relative humidity for at least 48 hours before making relative humidity measurements in the concrete. If this is not possible, a stable minimum ambient air temperature of 65° - 85°F, slab temperature of 60° - 80°F, and an ambient rH of no greater than 60% shall be required. Report all testing conditions; continuous data logging equipment for recording ambient

temperature and humidity during the testing protocol is required for accurate interpretation of test data.

B. Procedure

1. The number of ERHC test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
2. Perform the balance of all testing procedures specifically and exactly as outlined in ASTM F-2170-08, section 10.

3.2 QUANTIFYING PH LEVEL.

A. At each relative humidity test site and after monitoring of the site as outlined above, perform a pH test.

1. Wide Range pH Paper:

a. Use a wire brush to remove all loose sediment or foreign matter from the surface of the concrete; if heavy contamination is present (i.e. paint, drywall mud, etc.) lightly sand the area to be tested with heavy grit sand paper to expose a clean, uniform concrete surface; do not use a mechanical grinding methods (i.e. hand-grinder with diamond cup-wheel) prior to testing pH as this may excessively remove developed surface qualities of the concrete (useful carbonation) and skew testing results.
b. Place 6 – 10 drops of water onto the concrete surface to form a puddle approximately 1 inch in diameter.
c. Allow the water to set for approximately 60 seconds.
d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading.

2. Meter: Perform steps a) through c) as above for the use of Wide Range pH paper; utilize meter instead of paper at step d) operating meter per manufacturer's instructions.

B. Record and report results.

END OF SECTION 014500

SECTION 014523 – TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1. Refer to Division 01 Section “Summary of Work.”
2. Refer to Division 01 Section “Project Coordination.”
3. Refer to Division 01 Section “Quality Requirements.”

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements. The Owner reserves the right to take and analyze samples for conformity to contract Documents at any time.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
2. Inspections, test and related actions specified are not intended to limit the Contractor’s quality control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for the Contractor to provide quality control services required by the Owner or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and/or required by governing authorities, except where they are specifically indicted to be the Owner’s responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum. This includes work of sub-contractors.

1. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
2. The Owner shall engage and pay for the services of an independent agency to perform inspections and tests specified as the Owner's responsibility.

    a. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

3. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services proved unsatisfactory and do not indicated compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

    a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required test were performed on original construction.

4. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to:

    a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
    b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
    c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
    e. Security and protection of samples and test equipment at the Project site.

B. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicted as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.

1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

    a. The Owner is intending to employ MTC Materials Testing and Consulting, Inc. for soils testing, (360) 755-1990.
    b. The Owner has employed Welsh Commissioning Group for Commissioning, (253) 856-3322.

c. The Owner has employed MTC Materials Testing and Consulting, Inc. as the testing and special inspections agency for this project, (360) 755-1990.
d. The Owner may contract for roofing and envelope inspection services.
e. The Owner may contract for paint inspection services.

C. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

D. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition to Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, test, taking samples and similar activities.

1.4 SCHEDULE OF TESTS AND INSPECTIONS BY OWNER APPROVED TESTING AGENCY (AT OWNER'S EXPENSE)

A. Earthwork: Where compaction of disturbed soils is specified, test by probe and nuclear method is required.

1. Verify foundation subgrade conditions and ability to support recommended allowable bearing capacity.
2. Verify preparation of subgrades beneath floor slabs, paved areas, and other improved areas. Observe proof rolling activities on prepared subgrades.
3. Observe/monitor site excavation.
4. Verify fill placement and compaction of fill and subgrade soils.
5. Laboratory testing of proposed fill materials for grain size distribution criteria and to determine maximum dry density.
6. Verify installation of subsurface drainage system.
7. Observe installation of utilities and backfill placement and compaction.
8. Observe site grading and subgrade preparation activities.
9. Verify installation of Temporary Erosion and Sedimentation Control (TESC) components.

B. Concrete: Reinforcing steel type, size and placement; concrete strength, placement/consolidation of concrete, embed anchors or bolts for size and pull-out resistance and other requirements noted by ACI, the Structural Drawings or the authority having jurisdiction.

C. Masonry: Will be tested for mortar and grout strength; proper type, size and placement of reinforcing steel and consolidation of grout and other requirements noted by Masonry Institute, the Structural Drawings or the authority having jurisdiction.

D. Steel, Bolting and Welding: Welders WABO certified. Visually inspect steel as well as shop and pre-fabricated welds at the fabricator. Visually inspect field welds on-site. Compliance to I.B.C. required. Visually inspect correct embed, cleaning, and placement for expansion and epoxy type anchors. Inspect shear connectors and bolting.

E. Roofing: Owner may provide full time roofing inspection. Roofing manufacturer's representative shall provide inspection as necessary for issuing roofing warranty.

F. Owner may, at their option, engage paint inspection services.

1.5 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

a. Date of issue.
b. Project title and number.
c. Name, address and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Ambient conditions at the time of sample-taking and testing.
k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
l. Name and signature of laboratory inspector.
m. Recommendations on retesting.
n. Name and license or registration number of trades person performing the work being tested if that type of qualification/skill affects the quality of the work.

1.6 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are pre-qualified as complying with “Recommended Requirements for Independent Laboratory Qualification” by the

American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminated deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for “Cutting and Patching.”

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014523

SECTION 014554 – BUILDING ENVELOPE AIR BARRIER TESTING PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for air leakage testing of building envelope including:

1. Building envelope pressurization and depressurization testing.
2. Infrared thermography testing.

1.3 REFERENCES

A. Reference Standards: Current edition and conforming to provision of Division 01 Section "Reference Standards and Definitions."

B. Air Barrier Association of America (ABAA): http://www.airbarrier.org/.

C. American Society for Non-Destructive Testing (ANST): https://www.asnt.org/.

D. ASTM International (ASTM): http://www.astm.org/.

1. ASTM C1060 - Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings.
2. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
3. ASTM E 1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
4. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.

E. US Army Corps of Engineers (USACE), Engineer and Development Center:

1. USACE Air Leakage Test Protocol for Building Envelopes.

F. National Environmental Balancing Bureau (NEBB): http://www.nebb.org:

1. NEBB - Procedural Standards for Building Enclosure Testing (First Edition – 2013).

G. Washington Association of Building Officials (WABO), Washington State Building Code Council:

1. Washington State Energy Code (WSEC) [2009] [2012] edition. Website http://wabo.org.

1.4 DEFINITIONS

A. Air Barrier Accessory: Products designated to maintain air tightness between air barrier materials, air barrier assemblies, and air barrier components. Includes sealants, tapes, backer rods, transition membranes, nails/washers, ties, clips, staples, strapping, and primers.

B. Air Barrier Material: Primary element that provides designated plane of reduced air flow between different environments.

C. Air Barrier Assembly: Combination of air barrier materials and air barrier components designed to provide a designated plane of reduced air flow between environmental separators at portions of building envelope system.

D. Air Barrier Component: Pre-manufactured elements including windows, doors, and service elements installed in an environmental separator.

E. Air Barrier System: Combinations of air barrier assemblies providing designated planes of reduced air flow between different environments of a building envelope system.

F. Environmental Separator: Portions of building envelope that separates controlled interior environments from uncontrolled exterior environmental separators and areas of separation between spaces within building that have dissimilar environments.

G. Air Leakage Rate: Rate of air flow in liters per second (L/s), per unit area in square meters (m2), per unit of static pressure differential in pascals (Pa).

H. Air Permeance Rating: Quantitative measure of air diffusion through set surface area of material within a given time period under pressure differential between two sides of a material (in liters per second per square meter).

I. Building Envelope and Building Enclosure: These have essentially the same meaning and apply specifically to a continuous boundary or barrier, including perimeter floor, wall, and roof assemblies, separating interior building environmental conditions from surrounding outside/exterior environment.

1. Building Enclosure: May also apply to interior environmental separators.
2. Building Envelope: Used by Washington State and Seattle Energy Codes.

J. Building Envelope/Enclosure System: Provide a continuous, unbroken air barrier system surface area, including floors, walls/fenestrations, roof/ceiling areas, and multiple zones at interior functional air barrier enclosures.

1. Contractor to submit plans and drawings indicating proposed testing methods and areas.

K. Water Vapor Permeability: Coefficient of permeance to unit film thickness. Do not use except where film thickness is known and material is homogeneous.

L. Water Vapor Permeance: Ratio of unit water vapor transmission ratio (WVTR) to vapor pressure between two parallel surfaces of a flat material of known thickness.

M. Water Vapor Transmission Rate (WVTR): Steady water vapor flow in unit time through unit area of between specific parallel surfaces of a material, under specific conditions of temperature and humidity at each surface.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Conform to Division 01 Section "Project Coordination" for coordination with work of other Sections for following:

1. Cooperate with testing and inspection agencies.
2. Prepare building for testing and maintain testing conditions until testing completion.
3. Notify testing agency minimum 5 working days prior to testing to allow time for assignment of personnel and scheduling of tests following installation of air tight transitions between air barrier wall assemblies, air barrier wall components, and roofing assemblies.
4. Reimburse Owner or Inspection Agency where, without notification to testing agency, conditions are unsuitable or unavailable for scheduled testing and testing agency personnel made arrangements and arrived on site.

B. Preinstallation Meeting: Arrange in conformance to requirements of Division 01 Section "Project Meetings."

1. Attendance: Contractor, installer, Owner, Architect, air barrier manufacturer's representative, designated testing agency, installers representing related work, and those requested to attend.
2. Location: Project Site.
3. Agenda:

    a. Attendance at air barrier mock-ups.
    b. Responsibilities at transitions between air barrier assemblies and components.
    c. Procedures for preparation and conducting air leakage testing.
    d. Orifice blower door pressurization and thermal testing.
    e. Closing and sealing of windows, doors, ducts, plenums, and building areas of separation.

C. Sequencing and Scheduling: Conform to Section 013216 to meet Critical Path of Construction Progress Schedule:

1. Sequence, and schedule construction activities to allow testing and inspections to proceed without interruption or conditions resulting in inconclusive results.
2. Arrange time period for conducting air barrier testing after penetrations of air barrier system are complete and prior to covering and becoming inaccessible due to subsequent construction.
3. Close building access to non-testing personnel and suspend construction activities to allow unimpeded air leakage testing.

1.6 QUALITY ASSURANCE

A. Air Barrier Testing Agency: Performing testing and investigations of whole building envelope prior to closing off access to completed building air barrier system:

1. Specializing in work of this Section. Able to show minimum 2 years' experience testing to determine air leakage of air barrier assembly.
2. Provide qualified personnel to perform testing and inspections required under work of this Section.

a. Continuous Air Barrier Pressure Testing Personnel: Able to documented minimum 2 years of experience testing to ASTM E779 or ASTM E1827.
b. Infrared Thermographer: ANST Level II Certified to perform infrared diagnostic evaluation or documented minimum 2 years' experience performing building infrared thermography equivalent in scope and quality as specified by this Section.

1.7 SUBMITTALS

A. Submit under provisions of Division 01 Section "Submittal Procedures."

B. Qualification Data: Testing Agency and testing personnel qualifications conforming to or exceeding specified qualifications.

C. Testing Plan and Procedures: Testing plan and procedures. Include a complete set of report forms and sample documentation conforming to ASTM E779 or ASTM E1827 procedures.

D. Test Report: Indicate a pass or fail test result. Include testing calculation of air leakage using air flow measurements, tracer gas detection, thermal images, and other tests documenting locations and types of air leakage.

1.8 CLOSEOUT SUBMITTALS

A. Submit under provisions of Division 01 Section "Closeout Procedures."

B. Record Documentation: Maintain copies of inspections, testing, and laboratory reports at Project Site as Project Record Documents and submit to Owner and authorities having jurisdiction.

1.9 FIELD CONDITIONS

A. Ambient Conditions: Perform testing during conditions of calm winds, moderate temperatures, and low exposure to direct solar radiation as necessary to increase precision of test results.

1. Wind Velocity: Maximum 15 mph (6.7 m/s).
2. Temperature Difference: Minimum 10 degrees F (7.8 degrees C) between average exterior and interior building temperatures.
3. Solar Radiation: Do not conduct thermal imaging testing of surfaces exposed to direct sunlight. Consider testing after sunset or prior to sunrise.

4. Do not test in conditions where pressure gradients at building envelop caused by interior/exterior temperature differences, wind speed, and solar exposure are impractical for obtaining precise test results.

B. Temperature Factor due to Stack Effect:

1. Determine influence on building enclosure pressure due to building height and temperature factor.
2. Consider conducting orifice blower door test to ASTM E1827 where indoor/outdoor air temperature difference multiplied by building height exceeds a temperature factor of 2,360 foot degrees F (400 m degrees C).

PART 2 - PRODUCTS

2.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminated deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for “Cutting and Patching.”

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminated deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for “Cutting and Patching.”

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor’s responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 014554

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF REQUIREMENTS

A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection. Contractor is to pay all costs associated with items listed.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution.
2. Temporary electric power and light.
3. Temporary heat and humidity control.
4. Ventilation.
5. Telephone and facsimile service.
6. Data and internet service.
7. Photocopier service.
8. Sanitary facilities and services, including drinking water.
9. Storm and sanitary sewer.

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds.
2. Temporary roads and paving.
3. Dewatering facilities and drains.
4. Temporary enclosures.
5. Hoists and temporary elevator use.
6. Temporary project identification signs and bulletin boards.
7. Waste disposal services.
8. Construction aids and miscellaneous services and facilities.
9. First aid station.

D. Security and protection facilities include, but are not limited to, the following:

1. Temporary fire protection and fire watch.
2. Barricades, warning signs, directional signs and lights.
3. Secure enclosure fence for the site and/or work areas.
4. Landscape protection.
5. Environmental protection.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building codes requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department and rescue squad rules.
5. Environmental protection regulations including, but not limited to, control of storm water runoff, dust and noise.
6. State Department of Labor and Industries, WISHA and OSHA requirements.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

C. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," as prepared jointly by AGC and ASC for industry recommendations.

D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

C. The Contractor shall provide free, safe and unencumbered access on or across the site for personnel, vehicles and equipment authorized to use the site by the Owner but not under contract of the Contractor.

D. The Contractor shall assure free, safe and direct access to properties neighboring the site for owners of such properties, their guests, emergency and service/ delivery vehicles, where such access is by means of public streets or easement across the Owner's properties.

E. The Contractor shall maintain streets and sidewalks around the project site in a clean condition. By means of a regular monitoring and maintenance program of sweeping and hosing, minimize the accumulation of dirt and dust on said areas.

F. The Contractor shall protect all adjoining private or municipal property and shall provide barricades, temporary fences and covered walkways to protect the safety of passers-by, as required by prudent construction practice, local building codes, ordinances, other laws or the Contract Documents. The Contractor shall be responsible for preparing and submitting a traffic control plan, and right-of-way use applications to the City of Lakewood as necessary for the work.

1. It is not anticipated work will be required on or within City of Lakewood right-of-ways. The Contractor shall observe haul routes identified, and if not identified confirm acceptable haul routes with the City of Lakewood and the Owner.

G. The Contractor shall, at its sole cost and expense, promptly repair any damage or disturbance to walls, fences, utilities, sidewalks, curbs, landscaping and any other property of third parties (including municipalities) or work already existing resulting from the performance of the Work, whether by it, or by its subcontractors at any tier. The Contractor shall maintain streets in good repair and traversable condition.

H. The Contractor shall maintain both new and existing Work, materials and equipment free from injury or damage from rain, wind, storms, dust, frost or heat at all times.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General: Provide new materials. If acceptable to the Architect/Engineer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials of suitable size and type for use intended.

B. Lumber and Plywood:

1. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated or 5/8 inch thick if not indicated.
2. For safety barriers, sidewalk bridges, and similar uses, provide minimum 3/4-inch- thick exterior plywood. Thicker and stronger material shall be used as hazards require.

C. Tarpaulins: Provide heavy duty, waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins. Tarpaulins with noticeable cuts, leaks or soiling must be promptly replaced. Provide tie downs, weighting or other methods sufficient to keep units in place, without flapping, in heavy winds.

D. Water: Provide potable water approved by local health authorities.

E. Open-Mesh Fencing: Provide 11 gage, galvanized 2-inch mesh chainlink fabric fencing minimum 6 feet high. For in ground installation use galvanized steel pipe posts, 1-1/2 inches I.D. for line posts and 2-1/2 inches I.D. for corner posts. Where portable fencing is used, same gage, mesh and height but posts may be as standard for fencing system and shall seat tightly in concrete or other solid foundation blocks designed solely for use with fencing. Fencing shall be securely bolted or chained against unauthorized entry at all section joints and corners. Use of barbed, razor or electrified wire is not allowed.

1. Fencing at the perimeter of work, storage and staging areas shall be maintained on an on-going basis to prevent patient and public access at all times.
2. Provide visual screening fabric on fencing facing adjacent public and right-of-way areas. Screening is not required where temporary fence faces wooded areas.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect/Engineer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water: Existing water services on the site may be used for construction activities. Connection to hydrant identified on Civil drawings must include backflow prevention and metering. Provide water service as required by the work including all piping, trenching/ backfilling, valves, pressure reducing stations, taps and hose bibs. Provide water for both drinking and construction use and protect service from freezing.

1. Drinking water: Provide in single serving containers or by sanitary drinking fountains that are not used for other construction purposes.
2. Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge. Hoses with active leaks are to be promptly repaired or replaced.

C. Electricity: Obtain necessary temporary service and transformers from local utility as required to adequately power Project for all activities including, but not limited to: lighting, heating/cooling, ventilation, humidity control, and equipment/ tool power.

1. Electrical Distribution: Install panels, over current protection, circuits, breakers and distribution boxes to provide adequate and convenient service throughout the area(s) of the Work.
2. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
3. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

D. Lighting: Provide general service lamps of wattage required for adequate illumination for Work, general access/ egress and security. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior, wet location fixtures where exposed to moisture.

E. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed. Propane or gasoline fueled heaters, open flame heaters or "Salamanders" are not acceptable except on a case by case basis approved by the Architect/ Engineer in advance and in writing. Where heat is required for proper cure, drying or other necessary aspect of the Work, and where the fuel source requires periodic replenishment, the Contractor shall assign personnel to monitor such devices for proper operation and refuel them as necessary in work and non-work (evening/ weekend/ holidays) periods. Use of permanent units existing or provided under this contract is not permitted.

F. Humidity Control Units: Provide temporary humidity control units that have been tested and labeled by UL, FM, or another recognized trade association. Where humidification or dehumidification is required for proper cure; drying; keeping the Project on schedule or other necessary aspect of the Work, and where the fuel source requires periodic replenishment, the Contractor shall assign personnel to monitor such devices for proper operation and refuel them as necessary in work and non-work (evening/ weekend/ holidays) periods.

G. Ventilation Control Units: Provide temporary ventilating units that have been tested and labeled by UL, FM, or another recognized trade association. Where ventilation is required for proper cure; drying; worker or Occupant safety and comfort; keeping the Project on schedule or other necessary aspect of the Work, and where the fuel source requires periodic replenishment, the Contractor shall assign personnel to monitor such devices for proper operation and refuel them as necessary in work and non-work (evening/ weekend/ holidays) periods. Use of permanent units existing or provided under this contract is not permitted.

H. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

1. Provide office space adequate for all Contractor offices, job site meetings to accommodate 16 participants minimum, and superintendent’s office.

I. Owner’s Field Office (separate from Contractors): Provide a 120 square foot secure space within a construction office trailer (may be a space within the Contractor’s trailer) with a lockable entrance, operable window, and serviceable finishes; heated and air conditioned. Provide a desk, file cabinet, chair, side chair, and internet access.

J. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical or aerated recirculation type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Units to have privacy locks and to not have other types of locks that might allow personnel to be locked in.

K. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
2. Consult local Fire Marshall and appropriate Insurance Carrier for adequacy of protection provided and adjust as recommended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner’s easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for Change Orders.

B. Water Service: Install water service and distribution piping of sizes, at locations and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.
2. Water safety: Maintain all supplies so as to provide clean and fresh water. Do not allow leaks, overflows or other events to allow the accumulation of open containers, puddles or ponds of water that could become brackish, foul smelling or otherwise bothersome and/ or be a possible drowning or health hazard or any sort of nuisance to site users or neighboring properties.

C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

1. Where existing services are underground provide temporary electric power service underground. Where existing services are overhead, temporary service may be overhead.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
2. Do not allow lighting to cause glare or bothersome spillage onto neighboring properties, Owner occupied portions of the site or public right of ways.
3. Occupant Safety Lighting: Where the Work requires, or it is to the Contractors convenience, removal of existing site, parking, walkway, exit pathway, exit signs, emergency lighting or other lighting that provides site or building users with a certain level of safety and security, other temporary lighting sources shall be provided to ensure the same or a greater level of safety and security.

E. Temporary Heat and Humidity Control: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Concrete slabs moisture content: Concrete slabs will be subject to independent testing to verify moisture content is suitable for the installation of finish flooring products.
2. Readings which exceed the values indicated as acceptable in the Division 01 Section "Equilibrium Relative Humidity of Concrete Testing" shall become the responsibility of the General Contractor who shall take corrective actions, i.e. additional heat, dehumidification, acid wash, etc. to bring the slab into the acceptable level. This action shall be accomplished with no additional cost to the Owner.

F. Temporary Communications Devices: Provide temporary telephone, answering machine, photo copier, facsimile, and internet service throughout the construction period for all personnel engaged in construction activities. Note that wired connections (DSL, cable,

etc.) are not located in the vicinity of the project site. At the Contractor's option, provide hotspots and VoIP devices in lieu of landline connections.

1. Separate Telephone Lines, Hotspots and Devices: Provide additional telephone lines or devices for the following:

    a. Where the Contractor has more than one job office or trailer, install a telephone or hotspot for each additional location. These devices may be on the main Contractor number. On the main Contractor phone location provide an automatic answering machine or voice mail that picks up all calls after a certain number of rings.
    b. Provide a telephone and dedicated line in a covered location, accessible to all workers. This telephone may be a VoIP device or cellular if wired connections are not available.

2. At each telephone, post a list of important telephone numbers including emergency numbers.
3. Cellular telephone: The Project Superintendent(s) shall be provided with a mobile telephone to be operational and on his/ her person at all times during the Work. The number of this device shall be given to the Owner, Architect/ Engineer, and designated WSH staff.
4. Photocopier: Provide an operational photocopy machine in the Field Office or other convenient on-site location for use by construction personnel and accessible and open to the Owner's and Architect/ Engineer use. Regularly service and maintain the machine and provide on-site extra stock of paper, toner and other expendables for Project use. Must have capacity to feed multiple sheets of 11 by 17 inch paper and be so stocked.

G. Sanitary facilities: Include temporary toilets and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Use of permanent facilities existing or provided under this contract is not permitted unless explicitly noted.

1. Provide toilet tissue, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
2. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel where materials being handled or governing regulations and health codes require.

H. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

1. Provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).

I. Construction Cleaning and Janitorial Service: The Project shall be left broom clean at the end of each work day. Where the Project involves work in active Owner use areas in an occupied facility or site, including evening, night or weekend shift work, the Contractor shall provide daily janitorial services so that when the occupants return for their next

period of usage the facility is suitably clean as if maintained by the Owner's own staff. All construction debris, tools, materials and equipment shall be removed to a safe and secure location, not occupant accessible. The affected occupant areas shall be cleaned and dusted/vacuumed to include the floor, cabinetry, equipment, furnishings and all work surfaces including tack and marker boards.

J. Sanitary Sewers: If sanitary sewers are available and it is approved by the authority having jurisdiction, provide temporary connections to remove effluent that can be discharged lawfully. If sanitary sewers cannot be lawfully used for discharge of effluent, provide closed containers to remove and dispose of effluent off-site in a lawful manner. No effluent is to run off-site or be allowed to soak into or stand on grade on-site.

K. Storm Sewers: If storm sewers are available and it is approved by the authority having jurisdiction, provide temporary connections to remove run off that can be discharged lawfully. If storm sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, erosion control and similar facilities as required by local jurisdiction and as required to prevent all uncontrolled or unacceptable run-off from reaching neighboring properties, drainage ways, streams, rivers, ponds, lakes or other wetlands, Owner occupied portions of the site or public right of ways.

1. Filter out soil, construction debris, chemicals, oils, and all contaminants that might clog sewers, drainage ways or pollute waterways or soils, before discharge.
2. Maintain temporary storm sewers and drainage facilities in a clean, sanitary and fully functioning condition. Following use, restore to clean fully functioning conditions promptly. Assign responsible personnel and monitor facilities during storms and similar events to ensure full function of facilities and protections noted above. This monitoring shall take place around the clock and over weekends and holidays as events warrant. Damage to neighboring properties, waterways, wetlands, public right of ways, the Owner's property or the Work of this Contract due to failure to monitor or maintain shall be solely the responsibility of the Contractor. Damage shall be repaired to original or better condition and all fines/ penalties paid promptly.
3. Provide and maintain any temporary erosion and sedimentation control measures required by the local jurisdiction and the Contract Documents and any additional measures prudent to prevent uncontrolled or unacceptable storm water runoff from leaving the property.
4. Comply with NPDES, SWAPPP, and ecology general permit.

L. Provide earthen embankments, solid covers and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by rain or runoff of storm water and any additional measures prudent to allow maximally productive pursuit of the Work. Provide flashing marker lights, barricades, solid covers and other devices as necessary to keep workers or passersby from falling in excavations or tripping/ falling over hazards.

3.3 SUPPORT FACILITIES INSTALLATION

A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove no later than date of Substantial Completion.

B. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building or property lines. Comply with requirements of NFPA 241.

C. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly. If not otherwise noted in the Contract Documents, provide at least one dedicated 8 by 12 foot space for use for progress and other meetings. Furnish and equip as follows:

1. Furnish with a firm table, chairs, ample light, power, heat, ventilation, four by eight foot marker board and four by eight foot tack surface, securely wall mounted.

D. Storage and Fabrication Sheds: Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces.

E. Temporary Access Roads and Paving: Contractor is to provide all accesses and temporary roads on the site as necessary to allow expeditious prosecution of the Work whether or not they are indicated on the Drawings. Construct and maintain temporary roads and paving to adequately support loading anticipated and to withstand exposure to traffic during the construction period without allowing muddy, dusty or unsafe conditions to develop. Locate temporary access roads and paving for roads, storage areas, and parking where similar permanent facilities will be located, within the construction area, if possible. If it is necessary to locate accesses, roads or paved areas outside of the construction area delineated on the Drawings, confirm that such locations are acceptable to the Owner and the authority having jurisdiction.

1. Paving: Provide ample thicknesses of Asphalt Treated Base (ATB) or other approved material on prepared sub-grades where access must be assured.
2. Coordinate temporary road development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving and other Work of the Contract where the road(s) and the Work may be in conflict.
3. Install temporary paving to minimize the need to rework the installations and, where possible, to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, parking and supervision.
6. If temporary roads or other areas used be the Contractor, cross or conflict with public pedestrian, vehicular or other traffic, such crossing and conflict points shall be provided with traffic controls, crossing guards, flagmen or other such

controls and safeguards as necessary to allow safe and beneficial traffic conditions for all affected parties. Contractor operations causing unsafe conditions shall be halted immediately and safe alternatives explored and implemented.

F. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 31 and 32 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, theft, vandalism, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed or steel construction.

H. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Where elevators exist or are to be installed as part of the work, they are not permitted for Contractor's use unless specifically noted otherwise.

J. Temporary Signs: Prepare signs to provide directional and safety information to construction personnel, site occupants and visitors.

K. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed or site is occupied.

L. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

M. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance. Restore any damaged finishes to like new conditions.

1. Where scaffolding over 10 feet in height is in use, furnish scaffolding with integral stairs.

N. Vertical and Horizontal Access Systems: Where the height or reach distances of the work requires, provide scaffolds, staging, ladders, ramps, runways, platforms, railings, fall/drop prevention, hoists, cranes, chutes and other temporary access or protection systems as necessary to accomplish the Work. Provide and use in accordance with all applicable regulations and manufacturer's instructions. Check regularly and maintain in first-class condition.

1. Where work has the option of being accessed by scaffold or swing staging and the work requires special inspection, use scaffolding. Where the use of swing staging cannot be avoided, train, provide all safety equipment and escort special inspectors, Architect/ Engineer and Owner when they are involved with swing staging use.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as required by the Architect.

B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in all areas except as areas specifically designated for smoking.

    a. Smoking is strictly prohibited within the building enclosure.

4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition. Maintain fire watch personnel on-site during use of such devices and for adequate lengths of time after their use has been terminated to ensure sparks or embers are not smoldering in cavities or other previously undetected location.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities. Protect from damage and false alarms.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

E. Security Enclosure Fence: Before starting Work, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the portion determined sufficient to accommodate construction operations after obtaining owner approval. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates. Maintain strict accounting and control of keys and locks. If keys are lost or unaccounted for, the locks shall be immediately changed. All Contractor parking and construction trailers must be located inside the security fence.

1. Where projects are phased or otherwise have multiple stages, steps or where Owner occupancy will change over the course of a project, presume that fencing will have to be reconfigured accordingly as many times as necessary to safely and securely accommodate such phases, stages and changes.
2. At no time shall fencing be allowed to become a safety hazard to anyone or be unsecured/ unmaintained so that it does not afford reasonable security protection.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft or usable for vandalism, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism. Maintain strict accounting and control of keys and locks. If keys are lost or unaccounted for, the locks shall be immediately changed.

G. Landscape Protection: Protect existing trees, shrubs and lawns within and adjacent to the area of the Work where not scheduled for demolition or replacement. Where minor limb or root pruning is necessary to avoid interference with construction, employ a certified tree surgeon recognized by the International Society of Arboriculture or the National Arborist Association. Any pruning shall be approved by the Architect and the Owner's grounds maintenance staff prior to executing the Work.

H. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

1. Per the City of Lakewood Municipal Code 8.36.010 (B) (8), sounds originating from construction sites, including but not limited to sounds from construction equipment, power tools and hammering are prohibited between the hours of

10:00 p.m. and 7:00 a.m. on weekdays and 10:00 p.m. and 9:00 a.m. on weekends.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.

a. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.

C. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures, winds, snow loads, rain, storm water run-off, theft, vandalism, earthquake and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

D. Termination and Removal: Unless the Architect/ Engineer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other chemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, landscaping and sidewalks at the temporary entrances, as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

   a. Replace air filters and clean inside of ductwork and housings where permanent HVAC equipment was within the construction area whether or not it was routinely operating during the Work.
   b. Replace significantly worn parts and parts subject to unusual operating conditions.
   c. Replace permanent lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 015000

ss\December 20, 2017

SECTION 015010 – PROJECT IDENTIFICATION SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SECTION INCLUDES

A. Furnish, install and maintain temporary on-site project identification sign, informational signs and any other signs required by governing authorities or union contracts to identify project and direct traffic.

B. Allow no other signs to be displayed including:

1. Separate Contractor's, Subcontractor's, or supplier's signs or advertisements;
2. Signs which flash, blink, rotate or otherwise draw unusual attention, except where required by safety regulations;
3. Company or agency logos; and
4. Any sign or graphic on equipment that is objectionable to Owner.

1.3 SUBMITTALS

A. Design Data: Submit sign construction details. Where text may not be detailed, show layout of required information. Indicate margins, borders, spacing, and the like.

PART 2 - PRODUCTS

2.1 PROJECT IDENTIFICATION SIGNS

A. Project Identification Signs: Engage an experienced sign painter to apply graphics. Use painting or vinyl application as appropriate to use and with sufficient field life to be clean, neat and readily legible over the life of the project. Provide replacement sign when original has been damaged or has deteriorated. Comply with details indicated. If not indicated, provide as a minimum:

1. Size: 8'-0” x 4'-0”.
2. Number of signs: Four (4).

B. Graphic design, style of lettering, and colors: As indicated or directed. Colors to include background, two lettering colors and project graphic rendering.

C. Sign shall identify Project, Owner, Architect, Subconsultants, General Contractor and primary Subcontractors as follows:

1. Sign shall state most prominently the Owner's and project name; project title; Owner’s logo; scheduled completion date and budget.

2. Sign shall state secondarily, and as equals, the Design and Contractor teams.
3. Sign shall have a prominent notation in highly visible color such as yellow or red reading: "IN CASE OF EMERGENCY, CALL ###-####". Phone number to be supplied by the Owner.
4. Use black letters on white background with Owner's name and logo and emergency numbers in colors noted above.
5. Submit to the Owner and Architect/Engineer for approval, scaled signage layout drawing in color. Clearly and to scale, indicate size of letters and logo, color scheme and other pertinent data.

2.2 SIGN MATERIALS

A. Sign Surfaces: Exterior softwood plywood, 3/4 inch thickness, with medium density overlay.

1. Other sign surfaces may be submitted to the Architect for review and approval.

B. 2 Treated 4 x 4 10 foot posts per sign.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality. Use "Bulletin" colors for graphics. Colors for structure, framing, sign surfaces, and graphics: As indicated or directed.

2.3 FABRICATION

A. Paint all exposed surfaces of supports, framing, and surface materials. Apply one coat primer and one coat exterior paint.

B. Paint or apply graphics in styles, sizes, and colors, as indicated or directed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before application for first payment request, erect sign on the site at location as directed by Owner.

B. Set sign post 3'+ in ground.

3.2 MAINTENANCE

A. Maintain signs and supports in neat, clean condition. Repair damages.

3.3 REMOVAL

A. Remove temporary signs, framing, and supports at completion of project.

END OF SECTION 015010 ss\August 8, 2017

SECTION 015700 - EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes but is not limited to the implementation and maintenance of a comprehensive erosion control plan that complies with the City of Lakewood regulations. The contractor is responsible for implementing Best Management Practices (BMP's) in accordance with the City of Lakewood requirements. The information provided on the contract plans should be considered a minimum for the anticipated construction and conditions. The contractor shall be responsible for adding additional BMP's as conditions change at no additional cost to the owner. The Contractor shall coordinate installation and inspections of the BMP's with the City of Lakewood Clearing and grading Inspector. Additional BMP's shall be stockpiled on site as requested by the Clearing and Grading Inspector.

B. This Section includes the following:

1. Silt Control Measures
2. Temporary Stormwater Runoff Control
3. Measures to keep streets clean
4. P.E. sheeting cover for exposed soil
5. Maintaining, monitoring, and supplementing silt control, storm water runoff control measures and additional BMP's as required by the City of Lakewood and the NPDES permit.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 013323 "Submittal Procedures"
2. Section 312000 "Earthwork"
3. Section 334100 "Storm Drainage"

1.3 REFERENCES

A. WSDOT Standard Specifications Washington State Department of Transportation 2016 Standard Specifications for Road, Bridge, and Municipal Construction.

B. City of Lakewood Engineering Standards Manual (current edition)

C. Geotechnical Reports

1. Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report for Proposed Western State Hospital Commissary and Kitchen Building, by Associated Earth Sciences, Inc. dated September 27, 2017

D. NPDES: Construction Stormwater General Permit

1.4 SUBMITTALS

A. General: Submit in accordance with Section 013323 "Submittal Procedures".

B. Product Submittals: Product catalog cuts for silt fence, and siltsac inserts. Aggregate Materials: Coarse aggregate for gravel construction entrance.

C. Contractor shall prepare and submit a Surface Water Pollution Prevention Plan (SWPPP) as part of the Clear and Grade Permit.

1.5 REGULATORY REQUIREMENTS

A. Work to comply with City of Lakewood standards. The Contractor shall coordinate with the City of Lakewood Clearing and Grading Inspector.

B. Comply with the requirements of the NPDES Construction Stormwater General Permit.

1.6 NPDES CONSTRUCTION STORMWATER GENERAL PERMIT

A. Western State Hospital (WSH) has applied for, and is in the process of, securing the project's NPDES Construction Stormwater General Permit (herein referred to as the NPDES Permit) from the Department of Ecology. WHS will provide a copy of the NPDES Permit to the Contractor upon receipt.

B. Western State Hospital is currently listed as the Operator/Permittee for the NPDES Permit. Prior to commencing earth moving activities, WSH will transfer the permit to the Contractor after the contract has been awarded. WSH and the Contractor shall complete the "Transfer of Coverage" application to change the Operator/Permittee and the Contractor shall complete the On-Site Contact Person. The Contractor shall take on all responsibilities associated with the NPDES Permit including taking ownership of the Surface Water Pollution Prevention Plan (SWPPP), monitoring and reporting requirements for stormwater discharge for turbidity and pH, and all other aspects of the NPDES Permit, for the duration of the Contract. This scope of work is considered part of the base contract.

C. Contractor shall conform to all requirements in the NPDES Construction Stormwater General Permit including, but not limited to, the following:

1. Prepare and maintain the SWPPP. The Contractor will be responsible for maintaining and updating the SWPPP. A draft copy of the SWPPP has been submitted to the City of Lakewood and is included for reference. The Contractor shall take full ownership of this document as necessary to address the means and

methods, as well as to address site specific conditions that come up as part of the Contractor's inspections.

2. Have a Certified Erosion Control Lead (CECL) on site and available at all times. The Contractor shall provide the appropriate number of certified personnel to execute the work.
3. Provide and install required source control measures, Best Management Practices, storm water treatment measures, and maintain compliance with stormwater discharge requirements as specified in the NPDES Permit and summarized below in Part III of this document.
4. Test any stormwater runoff leaving the construction for turbidity and pH. Record results and submit reports to DOE per the NPDES standards.
5. File a notice of termination application to complete the NPDES permit once the site is stabilized according to DOE standards.

1.7 SEQUENCING AND SCHEDULING

A. Install erosion control measures in work areas prior to any clearing, grubbing, demolition, general site grading, or other construction in the area. Erosion control items shall be installed and removed at various times throughout the duration of the project.

1.8 MAINTENANCE

A. Maintain erosion control through the duration of the project.

B. Maintain erosion control after substantial completion per this section.

C. Provide continuous monitoring as required by the NPDES permit.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Filter Fabric Fence: In accordance with WSDOT Standard Specifications Section 9-33, Permanent Erosion Control, High Serviceability, Class B.

B. Straw Mulching: In accordance with WSDOT Standard Specifications Section 9-14.4(1)

C. Filter Fabric: Mirifi 140N or equal.

D. Filter Bag Inserts: Commercially manufactured filter bags specifically manufactured for silt filtering and which will provide filtering performance required. Contractor to verify current standards with the City of Lakewood Inspector.

E. Polyethylene (PE) Sheeting: In accordance with WSDOT Standard Specifications Section 9-14.5(3)

F. Storm Drain Pipe: Per Section 334100.

PART 3 - EXECUTION

3.1 GENERAL

A. The implementation of the Erosion Control system and the maintenance, replacement and upgrading of these facilities is the responsibility of the Contractor until all construction is approved. The Temporary Erosion and Sediment Control (TESC) facilities must be maintained in conjunction with all clearing and grading activities, and in such a manner as to insure sediment laden water does not enter the drainage system or violate applicable water standards in accordance with the City of Lakewood requirements and the contract documents.

B. The TESC facilities shown on the plans are the minimum requirements for anticipated site conditions.

1. During the construction period, the erosion control facilities installed may require maintenance, relocation or upgrading (e.g. additional sumps, relocation of ditches and silt fences, etc.) as shown on the plans or as needed.
2. Contractor shall pay for all costs associated with the construction, maintenance, upgrading and removal of the erosion control system throughout project duration.

C. Adequate temporary and permanent control of surface water runoff and subsurface seepage will be required in order to allow site access, grading, and construction of underground utilities to proceed.

1. Site preparation and initial construction activities should be planned to minimize disturbance to the existing ground surface particularly during extended wet weather periods when the presence of excess moisture will render the site soils more prone to disturbance.
2. During wet site conditions, equipment traffic should not be allowed on exposed subgrade areas. Erosion of the soil will occur as exposed surfaces are disturbed due to construction activity and exposure to climatic conditions.
3. The Contractor shall be responsible for protecting disturbed or prepared surfaces by some form of weather cover if left exposed for more than 2 days.
4. Contractor shall also protect disturbed or prepared surfaces from surface ponding, storm water runoff, and construction traffic.
5. The Contractor will be solely responsible for any repairs required to these surfaces at no additional cost to the owner.

D. Access Streets and Roadways: Provide wheel cleaning stations to clean wheels and undercarriage of trucks before leaving site, as necessary to prevent dirt from being carried onto public streets. If streets are fouled, clean immediately in conformance with City of Lakewood and all governing requirements and regulations.

3.2 TURBIDITY MONITORING

A. The Contractor shall be responsible for meeting turbidity and pH requirements as stated within the NPDES Permit. Additional TESC measures may be required to achieve

discharge requirements. The Contractor shall be responsible for providing additional measures as work progresses to meet turbidity requirements.

B. The proposed project will implement a turbidity monitoring program in compliance with the State Surface Water Quality Standards (WAC 173.201 A) for all stormwater runoff which leaves the construction site. The Contractor's CECL shall be responsible for coordinating the monitoring plan with the City of Lakewood Construction Inspector. Monitoring will be accomplished by testing on-site construction runoff flows discharging from the site. The CECL shall perform the turbidity measuring using an approved turbidity meter. The person performing the testing and monitoring shall be familiar with the turbidity meter and all applicable laws and regulations associated with the turbidity monitoring program.

C. Turbidity monitoring and reporting will be required daily during construction in the rainy season (November 1st through April 30th) and weekly between May 1 and October 31 for construction runoff leaving the site. Turbidity reports may not be necessary during extended periods of low flow or no flow conditions; the CECL shall coordinate this arrangement with the City of Lakewood Inspector. Due to the anticipated low flow or no flow conditions during the drier summer months, storm water flow may cease, causing an interruption in the turbidity monitoring and reporting.

D. The benchmark for turbidity is defined as:

1. 25 NTU (nephelometric turbidity units)
2. The contractor shall refer to the NPDES Permit for remedial measures when storm water discharging from the site has a turbidity measurement higher than 25 NTU's.

E. The CECL shall post the turbidity monitoring results on the Turbidity Testing Form contained within the NPDES Permit. The form shall be posted in the job trailer and distributed to the Owner, the City of Lakewood Inspector, and the Department of Ecology. The Turbidity testing results shall be posted immediately after the test is performed.

F. If during the construction season the monitoring reports indicate that the threshold level of turbidity is exceeded for construction runoff discharging from the site, the CECL must report the condition to the Clearing and Grading Inspector immediately, or as soon as practical. The Contractor shall maintain a stockpile of materials to implement additional BMP measures as required during construction to bring the project into compliance when the threshold level of turbidity has been exceeded. A final report must be submitted to the Clearing and Grading Inspector and the DEO once the site is fully stabilized.

3.3 pH MONITORING

A. The proposed project shall implement a pH monitoring program in compliance with the State Surface Water Quality Standards (WAC 173.201 A). The Contractor's CECL shall be responsible for coordinating the monitoring plan with the City Construction Inspector and the DOE.

B. The CECL shall be responsible for meeting pH requirements as stated within the NPDES Permit. Additional TESC measures may be required to achieve offsite stormwater discharge requirements. The Contractor shall be responsible for providing additional measures as work progresses to meet pH requirements at no additional cost to the owner.

C. pH monitoring shall be conducted with a calibrated pH meter, pH test kit, or wide range pH indicator paper.

D. pH monitoring shall begin when concrete is first poured and exposed to precipitation, and continue weekly throughout and after the soil-cement treatment and concrete pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 Standard Units (su). During this time, a representative sample must be obtained to conduct a pH analysis at least once per week.

E. pH shall be monitored in the sediment pond or other locations that receive stormwater runoff from the area of significant concrete work before the stormwater discharges to surface waters.

F. The acceptable range for pH is 6.5 to 8.5(su). Anytime sampling indicates that pH is lower than 6.5 or greater than 8.5, the Contractor must either:

1. Prevent the low or high pH water from entering storm sewer systems or surface waters; or
2. If necessary, adjust or neutralize the high pH water until it is in the pH is within the range of between 6.5 and 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO2) sparging or dry ice. The Contractor must obtain written approval from Ecology before using any form of chemical treatment other than CO2 sparging or dry ice.

G. The CECL shall post the monitoring results in the job trailer and distribute to the Owner and the City Inspector and submit online to DOE. The results shall be posted immediately after the test is performed. A final report must be submitted to the City Inspector at the conclusion of pH-altering processes.

H. If, during the construction season, the monitoring reports indicate that the threshold range of pH is exceeded, the CECL must report the condition to the City Inspector and DOE immediately, or as soon as practical. The Contractor shall maintain a stockpile of materials to implement additional BMP measures as required during construction to bring the project into compliance at no additional cost to the owner.

3.4 EXAMINATION

A. Verify locations of existing catch basins and related storm drainage features that may be impacted by construction activities.

3.5 PREPARATION

A. Locate existing utilities, avoid damage or disturbance. For aid in utility location call "Dial Dig 1-800-424-5555," 48 hours (two working days) prior to beginning construction. Provide and pay for additional marking as required.

B. Survey limits of work to install silt fence.

C. Perform clearing or other work required to installing erosion control.

3.6 CONSTRUCTION

A. Filter Fabric Fence: Field-adjust location to perimeter of clearing and stripping. Location shown on drawings is schematic. Cast all trench excavation soils from fence installation to the Construction side of fence. Overlap filter fabric fence joints minimum 1 foot prior to backfilling trench.

B. Polyethylene Sheeting: Overlap joints minimum 28 inches. Overlap in direction of drainage and prevent water from draining onto material being protected. Secure in place to prevent movement and damage. Provide sandbags at 2.5 feet spacing and tie the sand bags together with rope on slopes greater than 3:1. Minimize driving stakes through plastic.

C. Diversion Swales and Berms: Construct in a manner to intercept, divert, and channel runoff to sediment ponds. Plan locations are schematic. Field adjust, move, and reconstruct as necessary during construction to maintain drainage to sediment ponds and allow construction to proceed. Provide Straw bale check dams at minimum 100 feet spacing.

D. Straw Bale Check Dams: Construct such that drainage flows through bales. Bevel bale edges or fill gaps to insure drainage passes through straw filter. Larger flows may flow over top on occasion. Key bales into ground to prevent drainage under bales. Raise elevations of ends of check dams to prevent drainage around ends. Provide splash pad on downstream side to prevent scouring from high flows or overtopping.

E. Mulch: Mulch exposed soils not protected by other means. Provide continuous covering minimum depth of 3 inches. Apply mulch with tackifier to prevent blowing.

3.7 ADJUSTMENTS AND REVISIONS

A. Adjust or move swales, berms, pipes, culverts, bales, and silt fences as necessary during construction to direct site runoff to temporary ponds, silt filters, and grass swales.

3.8 PROTECTION AND MAINTENANCE

A. Protection:

1. Infiltration Systems:
   a. The Stormwater Plan includes the installation of permanent infiltration facilities. The Contractor is responsible for protecting these facilities during construction.

b. Excavate to a minimum of 3 feet above the design bottom elevation of the infiltration systems until the site is stabilized and only non-sediment laden water will enter the infiltration system. Contaminated infiltration system subgrades shall be repaired at the Contractor's expense.
c. Avoid compacting the subgrade of the permanent infiltration facilities.

2. Where possible, maintain natural vegetation for silt control.
3. Prevent silt-laden water from leaving site or from entering off-site storm sewer systems.
4. All slopes, cut, or fill areas where Work has stopped for more than 30 days shall be stabilized by mulching, polyethylene sheeting or other method to prevent erosion and sediment transport.
5. Keep all off-site parking areas and streets clean from construction activities. Paved surfaces shall be kept clean by the use of mechanical sweeping equipment, hand shovels and brooms or other accepted methods suitable of removing dirt, rock, silt and sand. No street washing will be allowed.

B. Supplementary measures:

1. Provide additional silt control and temporary erosion control measures as required to protect soils and prevent silt laden runoff from leaving project site at no additional cost to the owner.

C. Maintenance:

1. Monitor and maintain silt control measures. Remove accumulations of sediment when more than 50 percent of silt storage capacity is filled. Maintain all temporary erosion control facilities until need for each facility has been superseded by other stabilization methods or until Architect authorizes removal.
2. Inspect and repair temporary erosion control facilities. Inspect entire system to ensure proper operation a minimum of once per week, during and after storms, and prior to weekends and holidays.

D. Final Stablization

1. Final Stabilization shall be per the Construction Plans. All construction debris shall be removed. All temporary erosion control features shall be removed from the site and disposed of in a legal manner, and associated land disturbance shall be repaired to match existing conditions or conform to proposed conditions as required.

END OF SECTION 015700

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.3 ALTERNATIVE PRODUCTS AND SUBSTITUTION REQUESTS

A. The contractor shall investigate proposed substitutions with respect to the following:

1. Environmental concerns: Substitutions may impact LEED credit achievement. Contractor shall identify which LEED credit strategies may be affected by any proposed substitutions.
2. All Substitution Requests shall be accompanied with documentation that indicates the pertinent environmental performance criteria of the substitute material are equal or superior to the specified material.

1.4 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
2. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
3. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

B. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.5 SUBMITTALS

A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
2. Form: Prepare product list with information on each item tabulated under the following column headings:

a. Related Specification Section number.
b. Generic name used in Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.

3. Submittal Timing: Within ten (10) days after Award of Contract, submit two (2) copies or one (1) electronic copy of the product list to the Architect. Provide a written explanation for omissions of data and for known long lead items.

1.6 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner submit written documentation and point of contact from the manufacturer as to why the specification or schedule cannot be met. Consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two (2) or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer’s or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

    a. Name of product and manufacturer.
    b. Model, serial number and date of manufacture.
    c. Capacity.
    d. Speed.
    e. Ratings.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

    1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

B. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

C. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Store in the same position in which they will be installed.

D. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

E. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

F. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

G. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.

    a. Where Specifications specify products or manufacturers by name, accompanied by the term "or approved" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply

with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.

7. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 016000

SECTION 017123 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. General: This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:

1. Land survey work.
2. Special survey work for easements, utilities and other requirements of authorities having jurisdiction.

1.3 SUBMITTALS

A. Survey firms' name, address, telephone and fax number.

B. Key personnel assigned to the Work.

C. Record of Work: Upon request, submit record information and references attesting to the accuracy of previous work for this or other clients.

D. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements and stating if said improvements are conforming or non-conforming with the requirements of the Contract Documents. Deliver one original signed certificate to Owner and a copy to the Architect/ Engineer prior to Substantial Completion.

E. Final Property Survey: Submit six copies, one mylar reproducible and one DWG file format computer disk of the final property survey to the Architect/Engineer prior to Final Completion.

F. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Project Record Documents" and "Project Closeout" Sections. Such Record Documents to include, but are not limited to, the following:

1. Complete, accurate, neatly organized and legible log of control and survey work in a chronological or project progress order.
2. Certified and stamped survey prepared following installation of foundations and other major site improvements.

1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in the State of Washington, acceptable to the Architect/Engineer and Owner, to perform required land-surveying

services. All survey work is to be in conformance to recognized engineering survey practices.

1. Provide copy of Surveyor's State Registration.
2. Submit affidavit or insurance certificate affirming that Surveyor's Errors and Omissions Insurance is in force and will remain so for the duration of the project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Identification: The documents will identify existing control points and property line corner stakes where known. Where not so identified in the documents, Surveyor to locate and identify.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Establish and maintain the number of permanent benchmarks on the site as required by the Work, but not less than 2, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction.

1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.2 PERFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log legible and available for reference.

1. Record deviations from required lines and levels, and advise the Architect/ Engineer when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations and all other pertinent survey data of construction and site work.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

E. Existing Utilities: Furnish information necessary to adjust, move, protect or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.

F. Final Property Survey: Prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey.

1. Recording: Prior to Final Completion, have the final property survey recorded by or with local governing authorities as the official "property survey."

END OF SECTION 017123

SECTION 017329 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

1. Requirements of this section apply to all work, including, but not limited to, mechanical and electrical installations. Refer to Division 23 and Division 26 sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DESCRIPTION OF REQUIREMENTS

A. Definition: “Cutting and patching” includes cutting into installed construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

1. Cutting and patching is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.
2. Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection or installation processes is not considered to be “cutting and patching” under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be “cutting and patching.”

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal.

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building’s appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform work.

4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the work found to be unsatisfactory.

1.5 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Where cutting and patching involves addition of reinforcement to structural elements, submit a detailed request to the Architect at least seven (7) days prior to initiating work to allow for review of the request by the structural engineering consultant. Include in the request details and engineering calculations to show how reinforcement is integrated with the original structure.
2. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Shoring, bracing, and sheeting.
b. Primary operational systems and equipment.
c. Air or smoke barriers.
d. Water, moisture, or vapor barriers.
e. Membranes and flashings.
f. Fire protection systems.
g. Noise and vibration control elements and systems.
h. Control systems.
i. Communication systems.
j. Electrical wiring systems.

B. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer of fabricator to cut and patch the following categories of exposed work, or it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

a. Preformed metal panels.
b. Window wall system.
c. Veneer plaster.
d. Acoustical ceilings.
e. Carpeting.
f. Wall covering.
g. HVAC enclosures, cabinets or covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surface to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the project that might be exposed curing cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time ad complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer’s recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. Comply with requirements of applicable specification sections where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a smooth painted surface, after the patched area has receive prior and second coat, extend final paint coat over the entire unbroken surface containing the patch from floor to ceiling and to the nearest corner in both horizontal directions.

4. Patch, repair or rehang ceilings as necessary to provide an even plane surface of uniform appearance.

D. Plaster Installation: Comply with manufacturer’s instructions and install thickness and coats as indicated.

1. Unless otherwise indicated provide 3-coat work.
2. Finish gypsum plaster with smooth-trawled finish. Sand lightly to remove trowel marks and arises.
3. Cut, patch, point-up and repair plaster to accommodate other construction and to restore cracks, dents and imperfections.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

ss\November 1, 2017

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. Section Includes: Development and implementation of a Construction Waste Management (CWM) Plan during construction to salvage and/or divert construction, demolition and land clearing debris from this project from landfill disposal and incineration, as tracked through Construction Waste Management Reports

1. The Owner desires that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.
2. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled.

B. With these goals the Contractor shall develop, for the Architect's and Owner's review, a Waste Management Plan for this project. Attachments are included which may be used in the development of this plan.

C. Related Sections: The following sections contain requirements related to this section:

1. Division 01 Section "Sustainable Requirements."
2. Division 01 Section "Indoor Air Quality Requirements."
3. Divisions 03 – 26 Sections: Individual sections that involve finish materials that are located inside the vapor retarder as well as auxiliary finishing materials installed within the vapor retarder. This includes, but is not limited to, adhesives, sealants, paints, primers, carpets and composite wood products

1.3 REFERENCES

A. LEED Reference Guide, MR Credit 2 - Construction Waste Management section.

1.4 REQUIREMENTS

A. Develop and implement a Construction Waste Management Plan which includes the following Best Management Practices:

1. Reuse, salvage, or recycle waste materials to divert a minimum of 75% of total construction waste from landfill and incineration, and redirect recyclable material back to manufacturing process.

2. LEED Coordination Manager: Designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Construction Waste Management Plan for the Project.

    a. Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project. Conduct meetings, post signage, draft subcontractor agreements to communicate the goals of the waste reduction plan.
    b. Maintain current waste management records and perform calculations for the Project.

3. List of Recyclable/Salvageable Materials: Identify and include a list of potential materials for recycling and salvage, approximate volumes, waste hauler, and end product for the materials.

    a. Primary Recycling Target Materials: The following categories shall be diverted from landfill to a recycling facility:

        1) Land-clearing debris, excluding soil.
        2) Clean dimensional wood, pallet wood, plywood, OSB, and particleboard.
        3) Asphalt, concrete, brick and masonry.
        4) Ferrous and non-ferrous metals.
        5) Gypsum products.
        6) Acoustical ceiling tile.
        7) Cardboard, paper (including blueprints), paper-based packaging.

    b. Secondary Recycling Target Materials: The following categories shall be considered for diversion from landfill to a recycling facility:

        1) Paint.
        2) Glass (bottles and plate) porcelain.
        3) Plastics, plastic film, fiberglass (solid).
        4) Carpet and pad: 100% Reclamation.
        5) Non-asbestos roofing.
        6) Mechanical and electrical equipment.
        7) Batteries.
        8) Doors, windows frames, relites, hardware, millwork.

4. Materials Handling Procedures: Protect materials to be recycled from contamination. Handle, store, and transport materials in a manner that meets the requirements of the designated facilities for acceptance.

    a. Remove and relocate reusable materials to be reinstalled or retained in a manner to prevent damage or contamination.
    b. Conduct construction and demolition in such a manner to minimize damage to trees, plants and natural landscape environment.

5. Recycling and waste bin areas: Provide the necessary containers and bins, to facilitate the waste management program. Arrange for adequate collection, and transportation to deliver the recovered materials to the approved recycling center or processing facility.

    a. Separate construction waste at the project site by one of the following methods:

        1) Source Separated Method: Waste products and materials, that are recyclable, are separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Trash is transported to a landfill.
        2) Commingled Method: Selected waste materials are placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed and the remaining trash and waste materials are handled separately.
        3) Hazardous Wastes: Separate, store, and dispose of hazardous waste according to local regulations.
        4) Other methods proposed by the Contractor and approved by the Architect and the Owner.

    b. Keep recycling and waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
    c. As part of regular clean-up schedule visual inspections of dumpsters and recycling bins to identify potential contamination of materials.

6. Meetings: Identify and list the schedule, content, and participants in regular and pre-construction CWM meetings as defined in Meetings of this Section.

1.5 SUBMITTALS

A. Construction Waste Management Plan: Within fifteen (15) working days after receipt of the Notice to Proceed, or prior to waste removal, whichever occurs sooner, the Contractor shall prepare and submit a Draft Construction Waste Management Plan to the Owner's LEED Representative for approval.

1. The Draft Construction Waste Management Plan shall include the Best Management Practices described in Part 3 of this Section.
2. In the Plan designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Construction Waste Management Plan for the Project.
3. Once the Owner's LEED Representative has determined which of the BMPs contained in the draft Plan are acceptable, the Contractor shall submit, within 5 working days, a Final Construction Waste Management Plan.

    a. The Contractor shall distribute copies of the Construction Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect before work commences on the site.

b. Confirm to the Owner's LEED Representative in writing that each Subcontractor has received a copy of the approved Construction Waste Management Plan.
c. Approval by the Owner's LEED Representative and the Owner of the Contractor's Construction Waste Management Plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures specified.

B. Construction Waste Management Reports: The Contractor shall submit with each Progress Report a Construction Waste Management Report. The Construction Waste Management Report shall be submitted on a form acceptable to the Owner and shall contain the following information:

1. Use the LEED calculation methodology as defined in the LEED Reference Guide to determine the overall waste diversion rate for the Project.
2. Measurement of diversion rate is based upon either weight or volume, but must be consistent throughout.

a. If commingled recycling services are used, the recycling service must be required to provide hauling receipts outlining what percentage of weight was diverted from landfill and where each materials was diverted to.
b. Material sent to a landfill for use as ADC may only be included as "recycled" material in the construction waste management calculations if the landfill provides a letter stating the material was received from the project and was specifically used for ADC, including date of use.

3. If some of the materials will be donated or sold on-site auctions, describe the process and identify the organizations that may receive the materials.

C. Follow the specified method for monitoring and documenting the program, and submit a periodic report with each application for payment, including the following.

1. The amount (in tons or cubic yard of material) of material landfilled from the Project, the location of the Receiving Facility, how the waste will be reused or recycled, the total amount of tip fees paid at the landfill, and the total disposal cost including transportation costs, container rental costs, taxes, etc. Include manifests, weight tickets, receipt, and invoices.
2. The amount (in tons or cubic yard of material) and type of waste materials salvaged for sale, salvaged for reuse, and recycled. Provide the date removed from the jobsite, the location of the Receiving Facility, the amount of any money paid or received for the recycled or salvaged material, and the total disposal cost including transportation costs, container rental costs, taxes, etc. Include manifests, weight tickets receipts, and invoices. Obtain average recycling rates for each co-mingled material from each receiving facility where co-mingled waste materials are delivered.
3. Cost savings by waste material due to salvaging, reusing, and recycling materials. Calculate the savings based upon the cost per ton for disposal at landfill compared to the cost per ton for salvaging, reusing, and recycling materials.

4. Totals for date including: trash generated by weight and percentage of total; waste materials generated by weight and percentage of total identified by salvaged for resale, salvaged for reuse, or recycled; cost savings; and percentage of disposal fees saved.
5. For any waste material used as Alternate Daily Cover provide a letter stating the material was received from the project and was specifically used for ADC, including date of use.

D. Application for Progress Payments:

1. The Contractor shall submit with each Application for Progress Payment a Waste Management Report for the Project. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Contractor is ultimately responsible for implementation of the Waste Management Plan and achieving the diversion goals.
2. For each material recycled, reused, or salvaged from the Project, the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling the material. Attached manifests, weight tickets receipts or invoices.

E. Final Construction Waste Management Report: Include a summary of information required by Construction Waste Management Reports for the Project with the Final Report. Submit with Final Application for Payment.

1.6 MEETINGS

A. Pre-construction meeting:

1. Prior to beginning work at the site, or as each subcontractor commences work, schedule and conduct a meeting to review the Construction Waste Management Plan and related procedures, schedules, coordination and specific requirements for waste materials recycling and disposal.
2. Subcontractors shall be required to participate in pre-construction meetings.

B. Regular Meetings:

1. At a minimum, waste management goals and issues shall be discussed at regularly scheduled job-site meetings.
2. Subcontractors who will be on site prior to the next scheduled regular project meeting shall be required to participate.

1.7 REVENUES

A. Revenues or other savings obtained from recycling, reused or salvaged materials shall accrue to the Contractor.

PART 2 - PRODUCTS

2.1 WASTE CONTAINERS

A. Durable, covered, secured, reusable container for each category or waste.

B. Signs for each container: Exterior grade panel, painted, message in large letters identifying waste category and waste hauling/disbursement subcontractor.

PART 3 - EXECUTION

3.1 GENERAL

A. Minimize the creation of construction and demolition waste on the job site. When designing the Construction Waste Management Plan, the Contractor may use more than one of these practices (simultaneously or phased in) as work progresses. In general, the steps include:

1. Prevent waste in the first place:

a. Order materials precut to required size.
b. Order exact quantity required.
c. Use detailed take-offs to identify location and uses in structure to reduce risk of unplanned and potentially wasteful cuts.
d. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders or proceeding with work.
e. Protect products from damage during storage, installation and in-place.
f. Materials that become wet, damp or unusable for any reason due to improper storage shall be replaced at the Contractor's expense.
g. Request products delivered to the Site with packing materials that can be returned to sender, reused by others, or easily recycled.
h. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

2. Reuse materials that would otherwise become waste:

a. Use temporary materials and facilities that will be reused at other projects.
b. Reuse on-site waste for patching existing work.
c. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

END OF SECTION 017419

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. Description of General Requirements

1. Closeout is hereby defined as that phase of the Work occurring between the Date of Substantial Completion, as established by a fully executed Certificate of Substantial Completion, and the date of Final Completion, established upon the Contractor's completion of all the items of Work enumerated in Article 6.09 of the General Conditions.

1.3 FINAL CLEANING

A. See additional requirements in Division 01 Section "Final Cleaning."

B. Cleaning Materials: Only Green Seal (GS 37 Certified) cleaning materials shall be used in the final cleanup.

C. Recycle, salvage, and return construction and demolition waste from Project in accordance with requirements with Division 01 Section "Construction Waste Management."

1.4 SUBSTANTIAL COMPLETION

A. When the Contractor considers his work to be substantially complete, he shall complete the Substantial Completion Checklist, copy bound herein, and submit to Architect for review and recommendation.

B. Within a reasonable time after receipt of such notice, Architect will inspect project to determine completion status.

C. Should Architect determine that the Work is not substantially complete:

1. Architect will promptly return the Substantial Completion Checklist to Contractor, noting the reasons why the Work is not substantially complete.
2. Contractor shall remedy deficiencies in the Work and complete incomplete work noted by the Architect, and send a second Substantial Completion Checklist to the Architect, with all required attachments, upon completion/correction of the Work.
3. Architect will observe the Work again.

D. Should Architect determine that Work is substantially complete, he will:

1. Prepare a Certificate of Substantial Completion, copy bound herein, accompanied by list of items to be completed and/or corrected; and recommendation, together with all required Closeout documentation.
2. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them by Certificate and the value of all outstanding Work.

1.5 FINAL COMPLETION

A. When Contractor considers his Work 100% complete he shall complete the attached Final Completion Checklist, copy bound herein, and submit to Architect for review and recommendation, together with all required Closeout documentation.

B. Deficiency List

1. Final payment of funds reserved for Project closeout, and other withheld funds, will not be granted until all punch list items, and all administrative and procedural requirements, are complete. Each punch list item, when completed by the Contractor, must be initialed by the project superintendent prior to resubmission to the Architect.

C. With reasonable promptness after receipt of certification, Architect will observe to verify completion status. Should Architect consider Work to be incomplete, non-conforming or defective:

1. Architect will promptly notify Contractor in writing, listing incomplete, non-conforming or defective Work, including outstanding administrative actions.
2. Contractor shall take immediate steps to remedy stated deficiencies, and send second written certification to him that the Work is complete.
3. Architect will observe the Work again. If he considers the work to still be incomplete or defective, Architect shall be compensated for additional services.

D. Asbestos Free Certification

1. The Contractor shall certify that all new materials and products for this Contract are free of asbestos. Each supplier and sub-contractor shall warrant to the Contractor that materials and products provided by them as part of the work are free of asbestos. If specified materials or products are known to contain asbestos, the Architect shall be informed, and appropriate action shall be taken to provide asbestos free materials or products. Where any doubt exists, it shall be the responsibility of the supplier or sub-contractor providing the materials and products to verify test results showing that materials and products are free of asbestos.
2. Submit notarized statement on Contractor's letterhead addressed to the Owner certifying that "to the best of our knowledge" all materials and products provided for this Contract are free of asbestos. Asbestos free certification required prior to Substantial Completion and occupancy of the facilities.

E. LEED Submittals listed in Division 01 Section "Submittal Procedures" shall be provided prior to substantial completion.

F. Final Adjustment of Accounts

1. Submit a final statement of accounting to Architect.
2. Reflect all adjustments to Contract Sum for review, and revision if necessary, by Architect and Owner. Indicate the following:

a. The original Contract Sum.
b. Additions and deductions resulting from:

1) Previous Change Orders.
2) Alternatives.
3) Unit Prices.
4) Unused Allowances
5) Deductions for uncorrected Work.
6) Deductions for Liquidated Damages.
7) Other adjustments.

1.6 FINAL PAYMENT AND RELEASE OF RETAINAGE

A. Final payment shall be in accordance with the conditions of the Contract upon final acceptance by the Owner and receipt of properly prepared invoice voucher from the Contractor.

B. Release of retainage cannot occur until after a forty-five (45) day lien period has elapsed following the Final Acceptance of the Work and approval to release retainage from Labor and Industries, Department of Revenue, and Employment Security is received.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017700

Washington State Department of
Enterprise Services

DIVISION OF ENGINEERING AND ARCHITECTURAL SERVICES

SUBSTANTIAL COMPLETION CHECKLIST

Project Title: WSH New Kitchen Commissary Pharmacy	**Project Number:** 2016-41G (2-1)
Agency: DSHS	**Contractor:**
Facility: Western State Hospital	**Client Agency Rep:**
Architect/Engineer: NAC Architecture	**E&AS Project Manager:**

✓	ACTION:	VERIFIED BY	VERIFIED DATE
	1. Close-Out requirements identified at Construction Close Out Meeting		
	2. All FAs, COPs, and Change Orders submitted		
	3. All systems functioning as designed		
	4. Building Commissioning substantially complete (installation verification, system start up, functional testing, etc.)		
	5. All utilities and meters connected, tested and operational		
	6. Contractor's LEED submittals and reports completed and uploaded to USGB		
	7. Contractor submits notice of completion with remaining incidental corrective work (punch list)		
	8. A/E* schedules an inspection with the Owner, E&AS PM, and Contractor to inspect work and remaining punch list items. The A/E adds to contractor's punch list, creates a single supplemental punch list, and provides to the contractor within 2 business days.		
	9. Contractor establishes punch list completion schedule		
	10. If Prior Occupancy is established, per General Conditions Part 6.08, the areas of prior occupancy are: _____ Prior Occupancy Date(s): _____		
	11. A/E* confirms receipt of approved:		
	12. Notice from the A/E that the work is substantially complete		
	13. The E&AS PM and Owner determine the Substantial Completion date		
	14. Certificate of Substantial Completion issued and Warranty Period begins		

a. Occupancy Permit	N/A	j. Elevator Permit	N/A
b. Fire Marshal	N/A	k. Boiler Permit	N/A
c. Electrical Inspection	N/A	l. Dept of Health Permit	N/A
d. O&M Manuals	N/A	m. Dept of Ecology Permit	N/A
e. Draft "As-Built" Drawings	N/A	n. Staff Training	N/A
f. Shop Drawings	N/A	o. Keys and Key Schedule	N/A
g. Test Reports	N/A	p. Warranty Responsibility Contacts	N/A
h. Spare Parts and Materials	N/A	q. _____	N/A
i. Certificates of Warranty	N/A	r. _____	N/A

Notes: _____

* If no there is no A/E for the project, the E&AS PM will complete

Updated July 2017

Washington State Department of Enterprise Services

DIVISION OF ENGINEERING & ARCHITECTURAL SERVICES

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT TITLE: WSH New Kitchen Commissary Pharmacy

STATE PROJECT NUMBER: 2016-41G (2-1)

CONTRACTOR:

A/E CONSULTANT: NAC Architecture

OWNER/AGENCY: DSHS

DATE OF ISSUANCE:

DEFINITION OF SUBSTANTIAL COMPLETION

Part 6, paragraph 6.07, of the General Conditions of the Contract. "Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so the Owner can fully occupy the Work (or the designated portion thereof) for the use for which it is intended."

DESIGNATED PORTIONS OF THE PROJECT SHALL INCLUDE:

Work performed under this contract has been reviewed and to the best of our knowledge found to be substantially complete.

The Date of Substantial Completion for the work described above is hereby established as: _____

The Contractor will complete or correct the work on the list of items attached hereto within _____ calendar days.

RECOMMENDED BY:

A/E CONSULTANT — BY Signature — DATE

RECOMMENDED BY:

OWNER/AGENCY — BY Signature — DATE

APPROVED BY:

E&AS PROJECT MANAGER — BY Signature — DATE

ACKNOWLEDGED BY:

CONTRACTOR — BY Signature — DATE

Items to be corrected:

Washington State Department of
Enterprise Services
DIVISION OF ENGINEERING AND ARCHITECTURAL SERVICES

FINAL ACCEPTANCE CHECKLIST

Project Number: 2016-410G (2-1)		**Project Title:** WSH New Kitchen Commissary Pharmacy			
Contractor:		**Project Manager:**			
✓		**ACTION:**	**Reference Info.[1]**	**Verified By**	**Verified Date**
	1.	**Contractor:** Submit written notice that all incidental corrective work (punch list) completed	GC 6.09; per Spec.		
	2.	**Contractor: All work done per contract** Print Name: Signature: Date:			
	3.	**A/E[2]:** In consultation with E&AS PM and Owner, conduct a final on-site inspection of punch list to confirm completion.	GC 6.09; per Spec.		
	4.	**A/E[2]:** Confirms review and approval of final "As-Built" Record Documents from contractor	GC 4.02		
	5.	**PM:** Identify any and all claims and/or disputes	GC 6.09		
	6.	**PM:** Verify all FAs and COPs resolved, approved and all Change Orders processed	GC 6.09		
	7.	**Commissioning Authority Verification:** All post-commissioning fine-tuning complete and issues resolved	GC 6.09; per Spec.		
	8.	**Commissioning Authority:** Submit Commissioning Final Report (except seasonal testing)	GC 6.09; per Spec.		
	9.	**A/E[2] Recommendation of Acceptance** (All work acceptable per Contract) Print Name: Signature: Date:			
	10.	**Client Agency Acceptance** Print Name: Signature: Date:			
	11.	**E&AS PM Determination of Date of Final Completion** Print Name: Signature: Final Completion Date:			
	12.	**PM:** Verify statement of Apprenticeship Participation reporting complete. If goals weren't met, PM creates a memo for the project folder explaining why	Sup Conds 10.12; per Spec.		
	13.	**PM:** Verify any and all claims and/or disputes resolved	GC 6.09		
	14.	**PM:** Verify final contractor invoicing (100% & retainage as applicable) complete	GC 6.09; per Spec.		
	15.	**Contractor:** Submit final list of subcontractors, all tiers, that worked on the project	GC 5.04C		
	16.	**PM:** Verify all affidavits, including lower tier subcontractors, submitted to L&I	GC 5.04 RCW 39.12.040		
	17.	**PM:** Verify that final audit is complete and notify the Contracts Specialist to close the project in the DES Diversity Compliance program (B2Gnow)			
	18.	**E&AS APM Approves Closing the Contract** Print Name: Signature: Date:			
	19.	**CS:** Closes the contract and advertises the Final Acceptance date. 45-day lien period begins.			
	20.	**CS:** Notifies the A/E, Client Agency, and Contractor that the contract has been accepted.			
	21.	**PM:** Identify requested contract action	Close Agreements (A/E) ☐ Close Project ☐		

Footnotes:

[1] References are for information. Contractor shall refer to the Contract Documents to fulfill all contract requirements.

[2] If there is no A/E for the project, the E&AS PM will complete

SECTION 017710 - FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.

1. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Divisions 03 through 33.

B. General Project closeout requirements are included in Section “Closeout Procedures."

C. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
2. Burning or burying of debris, rubbish or other waste material on the premises is not permitted.
3. Only use products that are environmentally safe and that will not cause or contribute to Indoor Air Quality (IAQ) problems when the facility is occupied.

D. Cleaners shall be recognized industry professionals with at least 10 years experience in the post-construction cleaning of large commercial and institutional facilities. Cleaners shall have sufficient labor available to clean the entire project in a very tight time period and shall work evening, weekend and holidays as required to accomplish complete cleaning of the Project prior to Owner occupancy or during Owner's period of taking occupancy.

E. Should the Contractor fail in any of its duties described in this Section, the Owner may, at its sole discretion, have the Project cleaned thoroughly to its standards by a professional service. The Cost of this cleaning shall be deducted from the Contractor's Final Payment.

1.3 REFERENCES

A. Green Seal website http://www.greenseal.org/findaproduct/index.cfm for a list of approved products.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Materials: Only Green Seal (GS 37 Certified) cleaning materials shall be used in the final cleanup.

1. Do not use cleaning agents that might damage finished surfaces. Pay special attention to easily marred surfaces and reactive metals such as aluminum.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning operations for all trades. Employ professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a first class institutional building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion for the entire Project or a portion of the Project.

1. Clean the Project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
2. Remove tools, construction equipment, machinery and surplus material from the site.
3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Pay special attention to corners and other hard to clean areas. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
5. Broom clean and shop vacuum concrete floors in unoccupied spaces.
6. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if any visible wear, soil or odor is present.
7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds, advertising labels and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
8. Remove all visible labels that are not permanent labels and are not related to a products fire, mechanical or electrical rating.
9. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or

that show evidence of repair or restoration. Remove paint from "UL" and similar labels, including mechanical and electrical name plates.

10. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint, sealant and mortar droppings and all other foreign substances.
11. Clean plumbing fixtures to a sanitary condition, free of stains and film, including stains resulting from water exposure and from sealants.
12. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
13. Clean food service equipment to a sanitary condition, ready and acceptable for its intended use and obtain approvals by the Health Department.
14. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out or noticeably dimmed bulbs, and slow to start, defective and noisy starters.
15. Use metal detector to locate all metal objects, nails, etc. that may pose a hazard. Sweep all non-hard surface areas that were within or adjacent to any construction area or over which any construction related traffic traveled.
16. Leave the Project clean and ready for occupancy.

C. Pest Control: If pests have been observed, engage an experienced licensed exterminator to make a final inspection, and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Unless requested otherwise by the Owner, remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remain after completion of associated construction such materials shall become the Owner's property. At the Owner's direction, relocate these materials on site.

END OF SECTION 017710

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Submit separate manuals for the following:

1. Architectural and Miscellaneous Items.
2. Kitchen Equipment.
3. Pharmacy Equipment.
4. Central Services Equipment.
5. Commissary (warehouse) Equipment.
6. Mechanical.
7. Electrical.
8. Civil and Landscape.
9. Warranties.

B. Include all items with operable parts, items requiring periodic maintenance and/or cleaning, and items requiring delivery of spare parts and/or extra materials to the Owner, whether or not explicitly identified in the corresponding specification section.

C. Hard Copies: Submit two (2) each to the Hospital (1 to stay onsite at Building 22 and 1 for Maintenance records).

D. Electronic Copies: Submit two (2) complete pdf file or files, identical to hard copies, on CD/DVD(s). (1) for WSH & (1) for DSHS. Bookmark all Divisions and Sections. Do not submit electronic copy until final approval of hard copy.

E. Submit digital copies of photos taken during the course of construction on CD/DVD.

1.3 FORMAT – HARD COPY

A. Size shall accommodate 8 1/2" X 11" sheets. Binder spine width shall not exceed 3".

B. Cover and spline shall be embossed with:

1. Name of Project.
2. Name of Manual.
3. Name of General Contractor.
4. Month and year of Substantial Completion.

C. Binding: Hard cover, 3-hole screw post binding.

D. Tabs:

1. Primary Tabs indicating CSI Division. In the event that no data is required for a specific Division, insert sheet indicating so.
2. Secondary Tabs indicating each Specification Section within a particular Division, unless no data is required for the entire Division, in which case Section tabs are not required.

1.4 FORMAT – DIGITAL COPY

A. Furnish Owner with Adobe Acrobat compatible (*.pdf) file(s) on CD/DVD(s).

B. Scan printed material not already in electronic format and insert into electronic Operation and Maintenance Manual.

C. Organize electronic Operation and Maintenance Manual corresponding to hard copy Operation and Maintenance Manuals. Use same titles, content, and index following Specification Section numbers and titles. Bookmark all Divisions, Sections and Sub-sections.

1.5 CONTENTS

A. Table of Contents:

1. Arrange in same order as project specifications.
2. Identify with specification number.

B. Title Page:

1. Name, address, phone number and email address of General Contractor and all Subcontractors.
2. Name, address, phone number and email address of Architect.
3. Date of Substantial Completion.

C. Certificate(s) of Substantial Completion.

D. Product Data:

1. Item used shall be circled or otherwise clearly identified.
2. All model numbers, sizes, colors and custom modifications shall be clearly identified.
3. Include only sheets pertinent to project.

E. List of suppliers with addresses, phone numbers and email addresses, per CSI Section.

F. Receipts for spare parts, extra materials and all other equipment/items delivered to Owner.

1.6 REQUIRED INFORMATION

A. Certificates of Compliance.

B. Cleaning information and precautions.

C. Preventative maintenance guidelines and activities.

D. Parts list, reordering information and sources of supply.

E. Inspection procedures.

F. Operation instructions.

G. Special and standard product or equipment warranties and service/maintenance agreements.

H. System configurations and wiring schematics.

I. Lubrication and servicing data and schedules.

J. Recommended lamps.

K. Emergency Instructions.

L. MSDS sheets.

M. Test data.

N. Repair instructions.

O. Instances or conditions which will affect validity of warranties with supporting company contact information.

P. Other items identified in individual specific sections.

1.7 INSTRUCTION AND TRAINING OF OWNER'S PERSONNEL

A. Submit preliminary Operation and Maintenance Manuals prior to Substantial Completion and prior to the start of any instruction or training of Owner's personnel.

B. Submit a complete schedule of all training and instruction for review by Owner and Architect no later than 30 days prior to the anticipated date of the start of the training and instruction period. Indicate Division, Section, Sub-section, date, time, and instructor.

C. Instruct Owner's designated personnel in maintenance, adjustment and operation of products included in Operation and Maintenance Manuals. Coordinate with additional requirements of related Sections.

D. Demonstrate and instruct in classroom environment located at Project site.

1. Instructors: Qualified, authorized manufacturer's representatives, knowledgeable about the Project, specialist in trade and equipment involved.
2. Meeting Time: As mutually agreed. Complete required training prior to submitting notification of Substantial Completion, without exception.
3. Classroom Space: Mutually acceptable classroom within building facility.

E. Items Requiring Seasonal Maintenance: Arrange and perform additional instruction within six months of Date of Substantial Completion.

F. Hands-on-Training: Conduct at location utilizing actual in-place Work.

G. Use completed Operation and Maintenance Manuals and Project Record Documents as the basis for instruction.

1. Review contents of Operation and Maintenance Manual in detail.
2. Prepare and insert additional data when need for such data becomes apparent during instruction.

H. Explain aspects of operations and maintenance. Cover such items as tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and renewal of finishes.

I. Furnish additional instructional aids as handouts to attendees, including:

1. Written materials such as handouts, workbooks, and reference manuals. Supply one complete set for each attendee.
2. Audio/visual materials: Supply in triplicate.
3. All additional instructional aids shall be incorporated in the Final Operation and Maintenance Manuals (hard copies and electronic files).

J. Training Program Material: Becomes property of Owner during program.

1.8 OPERATION AND MAINTENANCE DIGITAL VIDEO RECORDINGS

A. Video record instruction and training, edit for clarity and correctness of instruction, and deliver to Owner prior to written notification of Final Completion.

B. Furnish for all mechanical and electrical systems and other systems, equipment and products as required by individual related Specification Sections.

C. Submit on CDs, DVDs or other formats as acceptable to the Owner.

D. Provide printed labels for all CDs/DVDs., identifying:

1. Project Name.
2. Date of training/instruction.
3. Specification number and description/name of system.
4. General Contractor, Subcontractor, and entity providing training.
5. Date or anticipated date of Substantial Completion.

E. Video Content: Cover recommended maintenance methods, procedures and materials in same order as presented in Maintenance Instructions section of Operation and Maintenance Manuals so that information is complementary and easy to follow.

F. Video Demonstrations:

1. Demonstrate in such a way as to make clear to maintenance and operations personnel how equipment should be operated and maintained.
2. Zoom in with camera on identifying labels, valves, switches and other small features as needed to clarify locations of specific items and demonstrate specifics.
3. Demonstrate manufacturer's recommended maintenance procedures such as servicing, lubricating, inspecting and testing.
4. Include graphic and written information on video as needed to adequately demonstrate operation and maintenance procedures

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017823

ss\November 6, 2017

SECTION 017836 - WARRANTY PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. Requirements

1. Comply with General Conditions.
2. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Specification Divisions.

B. Definitions

1. "Guarantee" and "warranty" are used interchangeably.
2. "Standard product warranties" are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
3. "Special warranties" are written warranties required by or incorporated in the contract documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

C. Types

1. Categories of warranties required for the Work include:

a. Special project warranty issued by Contractor and, where required, countersigned by installer or installers and/or other recognized entity involved in performance of the Work.
b. Specified product warranty issued by a manufacturer or fabricator for compliance with requirements in contract documents.
c. Coincidental product warranty, available on a product incorporated into the Work, by virtue of manufacturer's publication of warranty without regard for application requirements (non-specified warranty).
d. Refer to individual Specification Sections for requirements of specified warranties.

D. Disclaimers and Limitations

1. Manufacturer's disclaimers and limitations on product warranties shall not relieve the Contractor of the general warranty on the Work under this Contract that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

2. The Contractor is obligated to comply with warranties under the Contract or at law, regardless of the terms and conditions of warranties of supplier, manufacturer and subcontractors extended to the Contractor.

1.3 SUBMITTALS

A. General

1. Prepare per Division 01 Section “Submittal Procedures” and as follows.
2. The Contractor's written warranty shall be submitted to the Architect on the "Contractor's Warranty" form attached to this section or in a similar approved format.
3. For Subcontractor warranties as specified, a warranty by each such Subcontractor, countersigned by the General Contractor, shall be submitted to the Architect on the "Subcontractor's Warranty" form attached to this section or in a similar approved format.

1.4 WARRANTY OBLIGATIONS

A. Restore or remove and replace warranted Work to its originally specified condition at such time during warranty as it does not comply with or fulfill terms of warranty. Restore or remove and replace other Work that has been damaged by failure of warranted Work or which must be removed and replaced to gain access to warranted Work.

B. Except as otherwise indicated or required by governing regulations, warranties do not cover damage to building contents (other than Work of contract) that results from failure of warranted Work.

C. Cost of restoration or removal-and-replacement is Contractor's obligation without regard to whether Owner has already benefited from use of failing Work.

1.5 REINSTATEMENT OF WARRANTY

A. Upon restoration or removal-and-replacement of warranted Work that has failed as determined by Architect, reinstate the warranty by issuing newly executed form, for at least the period of time of the original warranty.

1.6 OWNER'S RECOURSE

A. Warranties and warranty periods do not diminish implied warranties and do not deprive Owner of actions, rights, and remedies otherwise available for Contractor's failure to fulfill requirements of the Contract Documents or rights and causes of action of or by the Owner available at law. Owner reserves right to reject coincidental product warranties considered to be conflicting with or detracting from requirements of the contract documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017836

ss/August 8, 2017

CONTRACTOR'S WARRANTY

Page 1

Date: _____ Contractor: _____

Owner: Department of Social and Health Services

Address: Western State Hospital

9601 Steilacoom Blvd SW, Lakewood, WA 98498

Project: Western State Hospital – New Kitchen Commissary Pharmacy

_____ (Contractor), the undersigned, warranties for a period of one (1) year from the date of Final Completion, all Work performed under the provisions of the Agreement Between the Owner and Contractor.

_____ (Contractor) will remedy any defects appearing during the warranty period which are due to failure, faulty materials, poor workmanship, or other nonconformity with or omission from the contract documents.

The following subcontractors performed the Work or furnished materials subject to warranty:

Trade Contact Person	Subcontractor and Address	Phone

CONTRACTOR'S WARRANTY
Page 2

Trade Contact Person	Subcontractor and Address	Phone

This warranty does not include holding the Contractor responsible for defects caused by unanticipated abuse; modifications not executed by the Contractor except when due to Contractor's failure to remedy defective conditions; improper or insufficient maintenance, and/or improper operation, except when performed by Contractor or when due to inadequate training of Owner's personnel; or wear and tear under normal usage.

Contractor: _____

Address: _____

Phone: _____

Contact Person: _____

Signature: _____

(Authorized Representative)

SUBCONTRACTOR'S WARRANTY

Date: _____ Subcontractor: _____

Owner: Department of Social and Health Services

Address: Western State Hospital

9601 Steilacoom Blvd SW, Lakewood, WA 98498

Project: Western State Hospital – New Kitchen Commissary Pharmacy

The General Contractor, _____, and the Subcontractor, _____, warranty for a period of _____ year(s), as specified in Section _____ of the contract documents, all Work performed under the provisions of the Agreement between the Owner and the Contractor. The undersigned will remedy any defects appearing during the warranty period which are due to failure, faulty materials, poor workmanship, or other nonconformity with or omission from the contract documents.

This warranty does not include holding the Contractor responsible for defects caused by anticipated abuse; modifications not executed by the Contractor except when due to Contractor's failure to remedy defective conditions; improper or insufficient maintenance, and/or improper operation, except when performed by Contractor or when due to inadequate training of Owner's personnel; or wear and tear under normal usage.

Trade: _____

Subcontractor: _____

Address: _____

_____

Phone: _____

Contact Person: _____

Signature: _____

(Authorized Representative)

Contractor: _____

Address: _____

_____

Signature: _____
(Authorized Representative)

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION

A. General Requirements

1. All work of this section is a part of the Contract and shall be provided at no additional cost to Owner.
2. Coordinate related requirements specified in other parts of the Project Manual.
3. Architect shall transfer as-built data provided by Contractor onto reproducible format.

B. Documents Required

1. Drawings, annotated as work progresses.
2. Project Manuals (specifications), annotated as work progresses.
3. Addenda.
4. Change Orders and other Contract modifications.
5. Architect's supplemental instructions, minor changes, clarifications and RFI responses.
6. Approved Shop Drawings, Product Data, and Samples
7. Field Test Records
8. Construction progress photographs on CD or DVD.

C. Maintenance of Documents & Samples - General

1. Store documents and samples in Contractor's field office apart from documents used for construction.

    a. Provide files and racks for storage of documents.
    b. Provide locked cabinet or secure storage space for storage of samples.

2. File documents and samples in accordance with Construction Specifications Institute (CSI).
3. Label each document "PROJECT RECORD COPY" in neat large printed letters. Maintain documents in orderly, clean and legible conditions. Do not use Record Documents for construction purposes.
4. Make documents and samples available at all times for inspection by Architect and Owner.

D. Marking Devices

1. Provide felt tip marking pens for recording information in color code. Color code legend on first sheet.

1.3 RECORDING

A. General

1. Project Record Documents shall be kept current and changes recorded concurrently as they are constructed. Do not conceal any work until required information is recorded.
2. Record Documents will be reviewed at weekly project meetings. Failure of the Contractor to maintain current Record Documents may result in the Contractor's delay of Final Completion of the Work, at the Contractor's expense.

B. Record (As-Built) Drawings

1. During the construction period, Contractor shall include on the "Project Record Copy" set of prints the following information as a minimum:

a. The size and location of all concealed or underground piping, conduit, ductwork and other utilities and appurtenance concealed in the construction, referenced to visible and accessible features of the site.
b. Details not on original Contract Drawings.
c. All approved deviations from the specifications and drawings, including addenda items, field orders, and change orders. Indicate change item numbers.
d. The location of any visible objects relocated due to interferences, or requested relocations submitted and approved on shop drawings.

2. Contractor shall remain available during closeout period to assist Architect with Record Document interpretation, correction and transfer of as-built drawings to reproducible format.
3. Record drawings shall comprise Civil, utility and survey drawings, plus all special equipment, all of which form a part of the Contract Documents.

C. Record Project Manuals

1. Maintain one copy of each Project Manual including addenda, Change Orders and similar modifications issued in printed form during construction, and mark-up variations in actual work in comparison with text and details of Project Manuals and modifications as issued.
2. Give particular attention to substitutions, selection of options, changes in details and schedules, and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable.
3. Legibly mark each Section to record Manufacturer, trade name, catalog number and supplier of each equipment item actually installed.

4. Addenda items and Change Orders associated with and/or affecting the Project Manuals shall be properly posted (i.e., cut out and placed in the Project Manuals at appropriate locations) and referenced in the record set.

D. Shop Drawings

1. Maintain as Record Documents; legibly annotate to record changes made after review.
2. Include subcontractor reproducible shop drawings for all special equipment including utilities, ground source heat pump piping and wells, and others as deemed appropriate. Record Drawing shop drawings shall be easily reproducible as appropriate and approved.

E. Record Product Data

1. Maintain one copy of each product data submittal, and mark-up variations in actual work in comparison with submitted information. Include both variations in product as delivered to site, and variations from manufacturer's instructions and recommendations for installation.
2. Give particular attention to concealed products and portions of the work that cannot otherwise be readily discerned at a later date by direct observation. Note related Change Orders and mark-up of Record Drawings and Project Manuals.

1.4 SUBMITTALS

A. General

1. Contractor shall, after a preliminary review by Architect, submit the complete set of Record Documents to Architect for review. Contractor shall make all corrections requested, and return the Documents to Architect. All such Documents must be submitted together, prior to Final Completion, and this submittal shall be a condition precedent to Architect’s Certification of final Application for Payment.

B. Submittal

1. Following Substantial Completion, prior to Final Completion and upon completion of final mark-up of Record Documents, deliver Record Documents to Architect:

a. One set of plans showing all changes incorporated in the Work.
b. One set Project Manuals showing all changes and information incorporated in the Work as specified.
c. One set shop drawings and Record Product Data with all information recorded as specified.
d. Surveyor's certificate per Division 01 Section “Field Engineering.”

C. Architect shall be responsible for transfer of Contractor as-built information to reproducible format.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017839

ss/November 6, 2017

SECTION 018113- SUSTAINABILITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This project will apply to the U S Green Building Council for building certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System® Version 2009. This rating system sets a standard definition for a commercial green building.

1. The system consists of five environmental categories containing 8 prerequisites and 46 credits, and additional categories for design innovation and regional priority. Each prerequisite and credit identifies the intent, requirements and submittals to achieve its specific goal.
2. Points are awarded for accomplishments in each credit area, and are added together in the LEED Scorecard to arrive at a total score for the building. Four award levels of achievement are possible: Certified (40-49 points), Silver (50-59 points), Gold (60-79 points) and Platinum (80 or more points).
3. A LEED rating is awarded based on the U S Green Building Council's review of the LEED Application that is created by the owner, design and construction team.

B. Related Sections: The following sections contain requirements related to this section:

1. Division 01 Section "Project Meetings" for LEED coordination meetings.
2. Division 01 Section "Submittal Procedures" for LEED submittals.
3. Division 01 Section "Product Requirements" for LEED substitutions.
4. Division 01 Section "Construction Waste Management."
5. Division 01 Section "Indoor Air Quality Requirements."
6. Division 01 Section "General Commissioning Requirements".

1.3 REFERENCES

A. There are three documents provided by the U S Green Building Council to explain the LEED Green Building Rating System and provide guidance to the achievement of each prerequisite and credit. Those documents may be obtained from their website at www.usgbc.org, and are:

1. LEED-NC 2009 Green Building Rating System for New Construction and Major Renovations. Document that briefly describes each LEED prerequisite and credit that can be downloaded free of charge.
2. LEED-NC 2009 Reference Guide. Document that includes the Rating System and expands on each topic to include green building issues, design approaches, calculation methodologies, references, definitions and case studies. This document is available for a fee from the website.

3. LEED 2009 Online Credit Forms. PDF form that prompts the responsible party to declare that the requirements of each prerequisite and credit are met. This document can be accessed by registered users to the LEED Online application system.

1.4 REQUIREMENTS

A. This project is targeted to earn a LEED Silver rating from the U S Green Building Council.

B. To achieve the LEED rating, applicant projects must satisfy all of the prerequisites and the number of credit points defined in the project LEED Scorecard. (See LEED Scorecard following this Section for reference only)

C. LEED requirements have been incorporated into the Contract Documents in support of the credits identified in the LEED scorecard. The specifications contain product criteria required to achieve particular LEED credits.

D. Achievement of LEED requirements are documented through LEED submittals which are provided to the U S Green Building Council in the LEED application. Contractor submittals are required to meet the LEED requirements. A complete list of required LEED submittals is provided in Section 01 33 23.

E. Designate a 'LEED Coordination Manager' from a permanent member of the construction team. The LEED Coordination Manager's responsibilities shall include, but are not limited to calculations, collection and collation of all materials to be turned over to Owner's LEED Representative for inclusion in the LEED Application.

1.5 COORDINATION

A. LEED Coordination: Coordinate LEED requirements, submittals and responsible parties, as required by LEED Coordination meetings defined in Division 01 Section "Project Meetings."

B. Air Quality Management Coordination: Coordinate per Division 01 Section "Indoor Air Quality Requirements."

C. Construction Waste Management Coordination: Coordinate recycling of materials with Owner, as required, to conform to the Construction Waste Management Plan defined in Division 01 Section "Construction Waste Management."

D. Commissioning Coordination: Coordinate with the project's commissioning provider to complete required commissioning process per Division 01 Section "General Commissioning Requirements."

E. Site and Tree Protection: Protection of soil, habitat and landscape amenities shall be coordinated per Division 32 Section "Landscape Installation."

F. Erosion and Sedimentation Control Coordination: Coordinate erosion and sedimentation control, as required, to conform to the Erosion and Sedimentation Control Plan defined in Division 01 Section "Erosion Control."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor participation is required to meet the LEED requirements.

B. Correction of work nonconforming with LEED credit requirements shall be performed at Contractor's expense, except for any work otherwise conforming to the contract documents. Contractor shall provide the necessary documentation to show compliance of corrected work. Owner's LEED Representative will be the sole judge in determining compliance with LEED credit requirements.

C. LEED Kick-Off Meeting: In accordance with Division 01 Section "Project Meetings," a two-hour LEED orientation session for construction forces will be scheduled by the Owner's LEED Representative and the Contractor's LEED Coordination Manager, at a mutually agreed date and time between Preconstruction Meeting and start of construction.

D. Session will be led by a LEED accredited professional familiar with Project. Attendance is required of Owner's Representatives, Commissioning Agent, Architect, Contractor's project manager, superintendent, Contractor's LEED Coordination Manager, project engineers, and representatives of primary subcontractors. Agenda will include:

1. Green building design principles and LEED rating system.
2. Green building features and requirements of this Project.
3. Review of Contractor's responsibility for quality control related to LEED.
4. Review of submittals required for LEED certification.
5. Contractor's responsibility for green building construction practices and documentation.

3.2 LEED SCORECARD – REFER TO NEXT PAGE

END OF SECTION 018113

ss/November 14, 2017
dj/August 23, 2017

50	11	5	Total Project Score	Possible Points 110

Certified: 40 to 49 points **Silver:** 50 to 59 points **Gold:** 60 to 79 points **Platinum:** 80 to 110 points

Sustainable Sites — Possible Points 26

Y	?	N			Req'd
Y			**SSp1**	**Construction Activity Pollution Prevention**	**Req'd**
1			SSc1	Site Selection	1
		N/A	SSc2	Development Density and Community Connectivity	5
		N/A	SSc3	Brownfield Redevelopment	1
		N/A	SSc4.1	Alternative Transportation: Public Transportation Access	6
1			SSc4.2	Alternative Transportation: Bicycle Storage and Changing Rooms	1
3			SSc4.3	Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles	3
2			SSc4.4	Alternative Transportation: Parking Capacity	2
1			SSc5.1	Site Development: Protect or Restore Habitat	1
1			SSc5.2	Site Development: Maximize Open Space	1
1			SSc6.1	Storm water Design: Quantity Control	1
1			SSc6.2	Storm water Design: Quality Control	1
		N/A	SSc7.1	Heat Island Effect: Nonroof	1
1			SSc7.2	Heat Island Effect: Roof	1
1			SSc8	Light Pollution Reduction	1

Water Efficiency — Possible Points 10

Y	?	N			Req'd
Y			**WEp1**	**Water Use Reduction**	**Req'd**
2			WEc1	Water-Efficient Landscaping	4
		2	WEc2	Innovative Wastewater Technologies	2
3	1		WEc3	Water Use Reduction	4

Energy and Atmosphere — Possible Points 35

Y	?	N			Req'd
Y			**EAp1**	**Fundamental Commissioning**	**Req'd**
Y			**EAp2**	**Minimum Energy Performance**	**Req'd**
Y			**EAp3**	**Fundamental Refrigerant Management**	**Req'd**
4	4		EAc1	Optimize Energy Performance	19
		N/A	EAc2	On-Site Renewable Energy	7
		N/A	EAc3	Enhanced Commissioning	2
	2		EAc4	Enhanced Refrigerant Management	2
1			EAc5	Measurement and Verification	3
	2		EAc6	Green Power	2

Y	YES - Credit included in design or planned for pursuit
?	MAYBE - Credit will potentially be achieved or pursued
N	NO - Credit not pursued or not applicable

Materials and Resources — Possible Points 14

Y	?	N			Req'd
Y			**MRp1**	**Storage and Collection of Recyclables**	**Req'd**
		N/A	MRc1.1	Building Reuse: Maintain Existing Walls, Floors, and Roof	3
		N/A	MRc1.2	Building Reuse: Maintain Interior Nonstructural Elements	1
2			MRc2	Construction Waste Management	2
		N/A	MRc3	Materials Reuse	2
2			MRc4	Recycled Content	2
2			MRc5	Regional Materials	2
		N/A	MRc6	Rapidly Renewable Materials	1
		1	MRc7	Certified Wood	1

Indoor Environmental Quality — Possible Points 15

Y	?	N			Req'd
Y			**EQp1**	**Minimum Indoor Air Quality Performance**	**Req'd**
Y			**EQp2**	**Environmental Tobacco Smoke (ETS) Control**	**Req'd**
1			EQc1	Outdoor Air Delivery Monitoring	1
1			EQc2	Increased Ventilation	1
1			EQc3.1	Construction IAQ Management Plan, During Construction	1
1			EQc3.2	Construction IAQ Management Plan, Before Occupancy	1
1			EQc4.1	Low-Emitting Materials: Adhesives and Sealants	1
1			EQc4.2	Low-Emitting Materials: Paints and Coatings	1
1			EQc4.3	Low-Emitting Materials: Flooring Systems	1
1			EQc4.4	Low-Emitting Materials: Composite Wood and Laminate Adhesives	1
1			EQc5	Indoor Chemical and Pollutant Source Control	1
1			EQc6.1	Controllability of Systems: Lighting	1
		1	EQc6.2	Controllability of Systems: Thermal Comfort	1
1			EQc7.1	Thermal Comfort: Design	1
1			EQc7.2	Thermal Comfort: Verification	1
1			EQc8.1	Daylight and Views: Daylight	1
1			EQc8.2	Daylight and Views: Views	1

Innovation and Design Process — Possible Points 6

Y	?	N			
1			IDc1.1	Innovation in Design: Exemplary Performance: SSc5.2	1
1			IDc1.2	Innovation in Design: Green Building Education	1
1			IDc1.3	Innovation in Design: Green Cleaning Policy	1
	1		IDc1.4	Innovation in Design: TBD	1
	1		IDc1.5	Innovation in Design: TBD	1
1			IDc2	LEED Accredited Professional	1

Regional Priority — Possible Points 4

Y	?	N			
		N/A	RPc1.1	Regional Priority - EAc1: 48%	1
		N/A	RPc1.2	Regional Priority - EAc2: 13%	1
		1	RPc1.3	Regional Priority - MRc7	1
1			RPc1.4	Regional Priority - SSc1	1
1			RPc1.5	Regional Priority - SSc5.1	1
1			RPc1.6	Regional Priority - SSc6.1	1

SECTION 018119- INDOOR AIR QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. The Contractor shall create and implement a construction indoor air quality management plan to maintain indoor air quality by controlling dust and pollutants.

B. Related Sections: The following sections contain requirements related to this section:

1. Division 01 Section “Project Meetings” for LEED coordination meetings.
2. Division 01 Section “Submittal Procedures” for LEED submittals.
3. Division 01 Section “Product Requirements” for LEED substitutions.
4. Division 01 Section “General Commissioning Requirements”.
5. Division 23 Section “Indoor Air Quality Assurance” for building flush-out requirements.
6. Divisions 03 – 23 Sections: Individual sections that involve finish materials that are located inside the vapor barrier as well as auxiliary finishing materials installed within the vapor barrier. This includes, but is not limited to, adhesives, sealants, paints, primers, carpets and composite wood products

1.3 REFERENCES

A. Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, Second Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
B. Filtration media: ASHRAE 52.2-1999.
C. Adhesives, sealants and sealant primers: South Coast Air Quality Management District (SCAQMD) Rule 1168 requirements, rules in effect on July 1, 2005.
D. Aerosol adhesives: Green Seal Standard for Commercial Adhesives GS-36, Requirements in effect on October 19, 2000.
E. Architectural paints, coatings & primers: Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.
F. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates: Green Seal Standard GC-03, Anti-Corrosive paints, Second edition, January 7, 1997.
G. Clear wood finishes, floor coatings, stains, sealers, and shellacs applied to interior elements: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
H. Carpet: Carpet and Rug Institute’s Green Label Plus program.
I. Carpet cushion: Carpet and Rug Institute’s Green Label program.
J. Hard-surface flooring, gypsum board, insulation, acoustic ceiling systems, wall base, wall coverings: California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350).

K. Acoustic Indoor Air Quality Testing: United States EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air.

1.4 REQUIREMENTS

A. Develop and implement an Indoor Air Quality Management Plan during construction that meets or exceeds the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, Second Edition 2007, Chapter 3. The required Best Management Practices are summarized in Part 3 of this Section.

B. Protect stored on-site or installed absorptive materials from moisture damage.

C. Use filtration media at each return air grill if air handling systems are to be used during construction.

D. Conduct a building flush-out or a baseline indoor air quality test procedure consistent with Part 3 of this Section.

E. Use low- or no-emitting adhesives, sealants, paints, primers, carpets and composite wood products within the vapor barrier. Refer to the Requirements within this Section.

1.5 SUBMITTALS

A. Make submittals in accordance with Division 01 Section "Submittal Procedures."

B. IAQ Management Plan: Within 60 working days after receipt of Notice of Award of Bid, or prior to HVAC work, whichever occurs sooner, the Contractor should submit 3 copies of the Draft IAQ Management Plan to the Owner's LEED Representative for approval.

1. The Draft Plan must meet or exceed the SMACNA Best Management Practices described in Part 3 of this Section.
2. In the Plan designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the IAQ Management Plan for the Project.
3. Once the Owner's LEED Representative has determined which of the BMPs contained in the above draft Plan are acceptable, the Contractor shall submit, within 14 working days, a Final IAQ Management Plan. The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Owner and the Architect.

C. IAQ Management Reports: The Contractor shall submit with each Progress Report a summary of IAQ Management issues. The Summary shall be submitted on a form approved by the Owner.

D. Provide a minimum of 18 photographs (3 each on 6 separate occasions) of construction IAQ management measures such as protection of ducts and on-site stored or installed absorptive materials.

E. Provide cut sheets of filtration media used during construction and installed immediately prior to occupancy with MERV values highlighted.

F. Submit one of the following.

1. A description of the building flush-out procedures aligned to the requirements in Division 23 Section "Indoor Air Quality Assurance" (may be included in the IAQ Management Plan), calculations demonstrating how the number of days of flush-out was determined, and dates of flush-out. Provide cut sheets of filtration media installed during flush-out and replaced immediately prior to occupancy, with MERV values highlighted.
2. A copy of the indoor air quality testing results demonstrating that the IAQ testing protocol has been met.

1.6 BUILDING FLUSHOUT MILESTONE DATE

A. The General Contractor shall include a separate milestone date on the CPM Schedule that indicates targeted date for the start of building flushout process.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill.

B. After construction ends, and prior to occupancy, replace filtration media with new Minimum Efficiency Reporting Value (MERV) 13 filtration media.

C. Use low-emitting products within the vapor barrier. This includes, but is not limited to:

1. Low or no-VOC adhesives and sealants such as multipurpose construction, glazing, pvc, carpet and pad, sheet flooring, tile floor, wood floor, cove base, countertop, tile countertop, grout sealant, cabinetry, laminate, sub-base, ductwork, fire caulk, acoustical and plumbing. VOC maximum limits are as shown in the VOC Limits table.
2. Carpet systems shall meet or exceed the requirements of the Carpet and Rug Institute's Green Label Plus Indoor Air Quality Test Program.
3. Resilient flooring, engineered and/or prefinished wood flooring, and tile flooring with factory-applied organic coatings/sealants shall comply with California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.
4. Gypsum board, acoustic ceiling tile, insulation, wall coverings, and wall base shall comply with California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

5. Composite wood and agrifiber products, including core materials, shall contain no added urea-formaldehyde resins. Adhesives used in field and shop-fabricated assemblies containing these products shall contain no added urea-formaldehyde resins. Products may include plywood, millwork, composite and solid doors, cabinetry, crown moldings, wood paneling and built in furnishings.
6. VOC Limits for LEED 2009:

SCAQMD Rule 1168, Adhesive and Sealant Application

Architectural Applications	VOC Limit [g/L less water]
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Wood Flooring Adhesives	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT & Asphalt Adhesives	50
Drywall & Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100

Substrate Specific Applications	VOC Limit [g/L less water]
Metal to Metal	30
Plastic Foams	50
Porous Material (except wood)	50
Wood	30
Fiberglass	80

Sealant Primers	VOC Limit [g/L less water]
Architectural Non Porous	250
Architectural Porous	775
Other	750

Specialty Applications	VOC Limit [g/L less water]
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Structural Wood Member Adhesive	140
Top & Trim Adhesive	250
Sheet Applied Rubber Lining Operations	850

Green Seal GS-36, Commercial Adhesives

Aerosol Adhesives	VOC Limit by Weight [%]
General Purpose Mist Spray	65%
General Purpose Web Spray	55%
Special Purpose Aerosol Adhesive	70%

SCAQMD Rule 1168, Adhesive and Sealant Application

Sealants	VOC Limit [g/L less water]
Architectural	250

Green Seal GS-11, Paints

Architectural Paints & Primers	VOC Limit [g/L less water]
Flats	50
Non-Flats	150

Green Seal GC-03, Anti-Corrosive Paints

Anti-Corrosive Paints	VOC Limit [g/L less water]
Anti-Corrosive/ Anti-Rust for Ferrous Metal Substrates	250

SCAQMD Rule 1113, Architectural Coatings

Architectural Finishes & Coatings	VOC Limit [g/L less water]
Bond Breakers	350
Clear Wood Varnish & Sanding Sealers	350
Clear Brushing Lacquer	680
Concrete-Curing Compounds	350
Dry-Fog Coatings	400
Fire Retardant Coatings, Clear	650
Fire Retardant Coatings, Pigmented	350
Floor Coatings	100
Graphic Arts (Sign) Coatings	500
Industrial Maintenance Coatings	250
Industrial Maintenance Primers, Zinc-Rich	340
Japans / Faux Finish coatings	350
Lacquer Sealer	550
Magnesite Cement Coatings	450
Mastic Coatings	300
Metallic Pigmented Coatings	500
Multicolor Coatings	250
Pretreatment Wash Primers	420
Primers, Sealers, and Undercoaters	200
Quick-Dry Enamels	250
Quick-Dry Primers, Sealers, and Undercoaters	200
Recycled Coatings	250
Rust Preventive Coatings	400
Shellacs, Clear	730
Shellacs, Pigmented	550
Stains	250
Waterproofing Sealers	250
Waterproofing Concrete/Masonry Sealers	400
Wood Preservatives	350

Laminating adhesives	No added Urea-Formaldehyde

PART 3 - EXECUTION

3.1 GENERAL

A. Many Best Management Practices are available to maintain IAQ during construction or demolition. The pros, cons, and limitations of each available option should be considered to identify the most effective and most efficient approaches for a particular job. When designing the Plan, the Contractor may use more than one of these practices (simultaneously or phased in) as work progresses. In general, the steps include:

1. Containing the work area
2. Modifying HVAC operation
3. Reducing emissions
4. Intensifying housekeeping
5. Scheduling material delivery to avoid contamination
6. Protecting stored and installed absorptive materials from contamination.

3.2 REQUIRED IAQ MANAGEMENT BMPS

A. Mechanical Systems:

1. Protection: All HVAC equipment must be protected from collecting dust and contaminants that can be collected in the system and later be released. Specific HVAC protection requirements generally apply to the return side, central filtration, or supply side of the system.
2. Return Side: The return side of an HVAC system is, by definition, under negative pressure and thus capable of drawing in nearby construction dust and odor. Special attention must be paid to the location of any return vents, return ducts, ceiling plenums, return shafts, VAV plenum intakes, window units, and transfer vents as well as that portion of the air handler which is upstream of the central fan. When possible, the entire system should be shut down during heavy construction or demolition that generates dust and airborne particles.

a. All return system openings in, or immediately adjacent to, the construction area should be sealed with plastic.
b. When the system must remain operational during construction, temporary filters should be added where necessary (e.g., on grills to return air shaft). Filters used during construction must have a minimum rating of MERV 8 and must receive frequent periodic maintenance.
c. Replace the filters at the end of the project with MERV 13 filters. Provide MERV 13 filters to process both return and outside air that is to be delivered as supply air. Verify that equipment is capable of accepting MERV 13 filters, or notify the Owner’s LEED Representative.
d. When the general system must remain operational, the heaviest work areas should be dampered off or otherwise blocked if temporary imbalance of the return air system does not create a greater problem.
e. The mechanical room should not be used to store construction or waste materials.

3. Supply Side:

    a. Diffusers, terminal units, and ducts may be adequately protected in most cases where the above measures are implemented. When the system is off for the duration of construction, diffusers and window units should also be sealed with plastic for further protection.
    b. Ducts, diffusers, and window units should be inspected upon completion of the work for the amount of deposited particulate present and cleaned where needed. If significant dust deposits are observed in the system during construction, some particulate discharge can be expected during start-up. When such a discharge is only minor, delaying re-occupancy long enough to clean up the dust may be sufficient. In more severe cases, installing temporary coarse filters on diffusers or cleaning the ducts may be necessary. The condition of the main duct should be checked whenever visible particles are discharged from the system.

B. Materials Handling: Protect construction materials from contamination and pollution from contact with construction dust, debris, fumes, solvents, and other pollutants.

1. The design of each system must be evaluated in detail to determine how it may be affected by odor and dust from the project (including site egress, staging areas, etc.).
2. Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
3. Protect stored on-site or installed absorptive materials from moisture damage.
4. Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
5. Schedule delivery of materials to minimize the duration of on-site storage.

C. VOC Control: Schedule installation of materials to minimize contamination of absorptive materials with VOCs, solvents, dust, etc. (For example, install carpet after painting has been completed, since carpet can absorb VOCs released while the paint dries).

1. All dry furnishings and materials (such as carpet, floor tile, acoustical tile, textiles, office furniture, wood shelving, etc.) shall be allowed to "air-out" or pre-condition prior to installation.
2. "Bake-outs" of furnishings and construction materials is not recommended due to questionable effectiveness and potential for damage.
3. Reduce exposure to VOCs as follows:

    a. An enclosed tanker is preferable to an open kettle for roofing.
    b. Containers of wet products should be kept closed as much as possible.
    c. Waste materials that can release odor or dust should e covered or sealed.
    d. Applying a sealer may control a surface that is persistent odor source.

D. Inspection: Conduct regular inspection and maintenance of indoor air quality measures including ventilation system protection.

1. Ductwork and appurtenances should be inspected upon completion of the work for the amount of deposited particulate present and cleaned where needed.

2. Both highly specialized equipment and professional expertise may be required to ensure that dust is effectively removed and contained.
3. The sequence in which duct cleaning occurs in the overall construction process needs to be carefully considered to avoid recontamination.

E. Modifying Equipment Operation: Use of equipment may need to be restricted in order to meet IAQ objectives. This could involve substituting cleaner equipment or simply changing operating Procedures. Examples of such controls include:

1. Restricting traffic volume or prohibiting idling of motor vehicles where emissions could be drawn into occupied areas.
2. Switching from diesel to biodiesel or bottled gas for equipment such as generators or forklifts (emissions are cleaner but still potentially harmful under some circumstances). Use of electric forklifts and other equipment should be considered when feasible, since they do not burn fossil fuels, thus eliminating exposure to combustion gas emissions.

F. Use low-toxic cleaning supplies for surfaces, equipment and worker's personal use. Options include Green Seal, citrus-based or soy-based solvent cleaners. Refer to Green Seal website for a list of approved products at http://www.greenseal.org/findaproduct/index.cfm.

G. Changing Work Practices: For some demolition tasks (e.g., paint stripping) there may be techniques available that produce less airborne dust. Some painting techniques release fewer odors. Some cleaning practices raise less dust.

H. Use wet sanding for gypsum assemblies. Exception: Dry sanding allowed subject to Owner approval of the following measures.

1. Full isolation of space under finishing.
2. Plastic protection sheeting is installed to provide air sealing during the sanding
3. Closure of all air system devices and ductwork
4. Sequencing of construction precludes the possibility of contamination of other spaces with gypsum dust
5. Worker protection provided.

I. Local Exhaust: Pollution sources can be directly exhausted to the outside. This may be done through an exhaust system already available in the building or more often by a portable fan vented to the outside and attached to the work site by flex duct. Depending on the nature of the material and the location of the exhaust, special filtration of the exhaust may or may not be necessary. Any emissions to the outside must be in compliance with applicable regulations and should be directed well away from intakes.

J. Air Cleaning: Where exhaust is not feasible, local re-circulation of air through a portable air cleaner may be effective. The type of filter should be suitable for the material being controlled (e.g., charcoal or potassium permanganate for many odors, a moderate to high efficiency filter for dust).

3.3 BUILDING FLUSHOUT OR IAQ TESTING

A. At the option of the Contractor conduct either one of the following.

1. Building Flushout: After point of substantial completion, but prior to occupancy, conduct a building flushout, as follows:

    a. Install all interior finishes.
    b. Complete dust- or chemical- producing activities such as painting, sealing, and sanding prior to initiating flushout. Punchlist items must be complete prior to commencement of flushout.
    c. Remove MERV 8 filtration media installed during construction. Install new MERV 13 filtration media. If equipment is not designed to accommodate MERV 13, create temporary fitting.
    d. Use ONE of the following flushout methods:

        1) Prior to occupancy, provide a total volume of 14,000 ft3 of outdoor air per ft2 of floor area while maintaining an internal temperature of at least 60°F and relative humidity no higher than 60%.
        2) Prior to occupancy, provide a minimum of 3,500 ft3 of outdoor air per ft2 of floor area to the space. During occupancy, provide a minimum of 0.30 cfm per ft2 of outside air or the design minimum outside air ventilation rate, whichever is greater, until a total of 14,000 ft3 per ft2 has been delivered. During each day of the flushout period, the flushout ventilation rate must begin a minimum of three hours prior to occupancy and continue while the space is occupied.
        3) Note: Temporary fans may be used to accomplish this flushout, as long as the required air quality, temperature and humidity targets are maintained.

    e. Flushout may be conducted in lieu of IAQ Testing.

2. IAQ Testing: Conduct a baseline indoor air quality testing procedure consistent with United States EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air. After point of substantial completion, but prior to occupancy, conduct a IAQ Testing, as follows:

    a. Randomly select sampling points in each portion of the building that is served by a separate ventilation system, with at least one sampling point for every 25,000 square feet, or for each contiguous floor area, whichever is larger.
    b. Collect the air samples between 3 feet and 6 feet from the floor, with all samples collected over a minimum 4-hour period.
    c. From the air samples collected, measure the maximum concentration levels for the chemical contaminates listed below:

        1) Carbon Dioxide (CO) 50 parts per billion.
        2) Formaldehyde 27 parts per billion.
        3) Particulates 50 micrograms per cubic meter.
        4) Total Volatile Organic Compounds (TVOCs) of 500 micrograms per cubic meter.

5) 4-PCH of 6.5 micrograms per cubic meter. This test is required only if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed in the building.
6) Carbon Monoxide (CO) of 9 part per million or no greater than 2 parts per million above outdoor levels.

d. For each building area where the maximum concentration limits are exceeded conduct a partial building flushout, and then retest the specific parameter(s) exceeded to confirm the requirements are achieved. Repeat procedure until all requirements have been met. When retesting, air samples should be taken from the same location as the first test.
e. Provide a copy of the IAQ testing results indicating that the maximum chemical contaminate concentration requirements are not exceeded.
f. Testing may be performed in lieu of the building flushout.

END OF SECTION 018119

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Description of Work
2. Payment Requirements and Commissioning Schedule of Values
3. Commissioning Coordination and Meetings
4. Scheduling Commissioning Activities
5. Submittals
6. Duties of Commissioning Authority
7. Duties of Contractor
8. Duties of Contractor's Commissioning Coordinator
9. Back-Charging Provisions
10. Documentation Requirements
11. Start-up Requirements
12. Installation Verification Requirements
13. Functional Testing Requirements
14. Commissioning Issue Documentation and Correction
15. Performance Period
16. Project Closeout
17. Seasonal Testing
18. Near Warranty End Review

B. Related Sections:

1. General Requirements to include the following sections, exact titles may vary.

   LEED and sustainability requirements
   Indoor Air Quality Management
   Project Management and Coordination
   Submittals
   Closeout Procedures
   Operation and maintenance Data
   Demonstration and training

2. The following sections specify the commissioning activities for this project:

   11 08 00 Commissioning of Equipment
   20 08 00 Commissioning of Mechanical
   21 08 00 Commissioning of Fire Suppression
   22 08 00 Commissioning of Plumbing
   23 08 00 Commissioning of HVAC
   25 08 00 Commissioning of Controls
   26 08 00 Commissioning of Electrical
   28 08 00 Commissioning of Electronic Safety and Security

3. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

DIVISION 11 – EQUIPMENT

Walk-in Coolers

DIVISION 20 – MECHANICAL

Testing, Adjusting and Balancing

DIVISION 21 – FIRE SUPPRESSION

All Fire Suppression Systems

DIVISION 22 – PLUMBING

Domestic Hot Water Heaters & Circulators

DIVISION 23 – HVAC

All HVAC Systems

DIVISION 25 – INTEGRATED AUTOMATION

All Building Automation and Control Systems

DIVISION 26 – ELECTRICAL

Lighting Control

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Fire Alarm

1.2 DESCRIPTION OF WORK

A. Work includes the completion of formal commissioning procedures on selected equipment and systems as outlined in the paragraph Related Sections above. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the Contract Documents. Commissioning procedures will be designed and conducted under the direction of a Commissioning Authority (CxA) hired by the Owner.

B. This section contains the general requirements for commissioning and a description of the commissioning process to be applied across all commissioned systems.

1.3 PAYMENT

A. Equipment and systems shall not be accepted by the Owner, and final payment shall not be made by the Owner, until commissioning activities identified in the specifications are complete, commissioning issues are resolved to the Owner's satisfaction and the performance period standards have been met including seasonal testing.

B. Payment is subject to the conditions of the Actual Damages clause of the General Conditions.

1.4 COMMISSIONING COORDINATION AND MEETINGS

A. A representative for the Contractor, each commissioned system Contractor and the Contractor's Commissioning Coordinator (CCC) shall attend scheduled commissioning meetings as required.

1.5 SCHEDULE

A. The Contractor is responsible for coordination and scheduling of commissioning activities into the master schedule. The schedule shall contain the following activities and detail as a minimum.

1. Contractor review and comment on preliminary commissioning plan documents
2. Start-up Plan Development
3. Start-up Activities by Equipment and Systems
4. Installation Verification Activities by Equipment and Systems
5. Functional Testing Activities by Equipment and Systems
6. Training
7. O&M
8. Seasonal Testing

B. The CCC shall develop and maintain a 2-week look-ahead schedule of commissioning activities including, but not limited to: meetings, start-up, installation verification, Functional Performance Testing (FPT) and FPT demonstration. The schedule shall be updated and distributed weekly, or if any currently scheduled activities in the 2-week period change.

C. The Owner and the CxA will allocate their time based on the 2-week look-ahead schedule. If the Owner or CxA is not available for the scheduled activity then the Contractor may proceed as scheduled. If a scheduled activity does not take place due to lack of Contractor participation or inaccurate scheduling, the Contractor is subject to back-charging as outlined herein.

1.6 SUBMITTALS

A. Commissioning Documentation: Provide one copy of submittals in addition to those quantities specified elsewhere. Include the manufacturer's recommended installation and start-up procedures with associated checklists for each unique piece of equipment under a separate tab titled "Installation/Start-up". These procedures and forms shall be for the specific piece of equipment to be provided.

B. The Contractor shall provide the CxA with copies of approved submittals, manufacturer's recommended installation/start-up documents, proposed testing formats, training plans, as-built

documentation, O&M Manuals and other commissioning related materials as requested by the CxA. The CxA will review and approve this material for commissioning related activities.

C. The CCC is responsible for managing the submittal process with the CxA. A tracking document for selected submittals is included in the schedules at the end of the individual divisional commissioning specifications for systems to be commissioned. These schedules outline activities that will require specific submittal information by the Contractor. Assignment of Contractors responsible for commissioned systems and due dates will be determined at the initial commissioning coordination meeting.

D. O&M manuals for each piece of commissioned equipment are to be submitted with the proposed installation, testing and start-up documents.

E. The Contractor is responsible for providing the CxA with copies of the following information for inclusion in the Systems Manual. The CxA will review this material for compliance with Project Documents and will note and report issues for resolution by the responsible party. The CxA will compile the final Systems Manual based on the submitted documentation.

1. As-built documents
2. Description of systems, including capabilities and limitations
3. Operating procedures for all normal, abnormal, and emergency modes of operation
4. Sequence of operation as actually implemented, with control systems data including all set points, calibration data, etc. This includes but is not limited to the building automation system, packaged controls, programmable logic controllers and lighting controls.
5. Location of all control sensors and test ports.
6. Seasonal start-up and shutdown procedures.
7. Control schematics and computer graphics for all control systems including those noted in item 4.
8. Complete terminal interface procedures and capabilities for all control systems including those noted in item 4.
9. A list of recommended operational recordkeeping procedures including sample forms, trend logs, or others, and a rationale for each
10. Maintenance procedures for all building systems.

1.7 COMMISSIONING AUTHORITY

A. The information provided herein regarding the Commissioning Authority's (CxA) responsibilities is provided to the Contractor for information only and is not a part of the work scope. The CxA is hired under direct contract with the Owner.

B. The CxA for this project shall be Welsh Commissioning Group, Inc. (253) 856-3322, FAX (253) 859-2072 (www.wcxg.com).

C. Responsibilities: The CxA responsibilities include, but are not limited to the following:

1. Approve selection of the CCC.
2. Participate in the initial on-site commissioning coordination meeting and subsequent commissioning meetings.
3. Conduct site observations and provide site observation reports.

4. Review and approve the start-up plan and commissioning schedule as developed by the CCC and the Contractor.
5. Develop the commissioning plan including start-up plan, installation verification checklists and functional test documents
6. Review and approve various Contractor completed documents including CCLs, start-up documents and data sheets as they are completed.
7. Witness, spot check or otherwise verify successful completion of selected functional testing by Contractor.
8. Review the TAB report. Witness or spot check a sample of the systems to verify conformance to design and the report.
9. Prepare and submit final commissioning report with recommendation for system acceptance to the Owner. Report is developed with material provided by CCC and Contractor.

1.8 CONTRACTOR

A. Contractor Responsibilities

1. Support the commissioning process including integrating related commissioning activities into the construction process and schedule.
2. Assure the participation and cooperation of subcontractors as required to complete the commissioning process as outlined herein and the individual divisional commissioning specifications.
3. Assign a Commissioning Coordinator dedicated to the project.
4. Provide all submittal material as requested by the CxA and as required by the contract documents.
5. Attend commissioning meetings as scheduled.
6. Provide access to commissioned systems including ladders, lifts, scaffolding, access panels and other equipment as required.
7. Install and start-up equipment per the contract documents and start-up plan.
8. Conduct functional testing per the contract documents and commissioning plan
9. Provide required test instrumentation and equipment as needed to conduct functional testing per the commissioning plan.
10. Resolve issues as noted on the commissioning issues list and communicate resolution to the CxA.
11. Support seasonal testing as required.
12. Support the near-warranty-end review and correct any noted issues prior to warranty end.

1.9 CONTRACTOR'S COMMISSIONING COORDINATOR

A. Contractor's Commissioning Coordinator (CCC) Qualifications

1. The CCC shall be a regular employee of the Contractor assigned to the project. The CCC shall be responsible for coordination of Contractors responsible for commissioned system regardless of the Contractors they represent.
2. The CCC responsibilities shall not be shared by multiple parties, one individual shall be designated.
3. The individual designated as the CCC shall be available on site from the beginning of construction to final acceptance.

4. The individual designated as the CCC may have other construction or project related assignments, but only to the extent that they will be able to fulfil the CCC responsibilities outlined herein.
5. The individual designated as the CCC shall be identified by the Contractor during the submittal process.
6. Submit the name, company, contact information (address, phone, cell phone, FAX and e-mail) and other project duties for the proposed CCC.

B. Contractor's Commissioning Coordinator Responsibilities

1. Overall management and coordination of the commissioning work performed by the Contractors responsible for commissioned systems including responsibilities identified as the CCC's responsibility in each section on commissioned systems.
2. Coordinate Owner and CxA participation in scheduled commissioning activities. Notify Owner and CxA a minimum of 5 working days in advance of commissioning activities.
3. Collect, review and submit commissioning material and documentation to the CxA for approval prior to proceeding with commissioning activities including, but not limited to, the following:

    a. Review and comment on preliminary functional tests provided by CxA. Contractors responsible for the systems to be commissioned shall also review this information.
    b. Develop, manage and update commissioning schedule with commissioning activities
    c. Proposed Manufacturer's installation and start-up documents
    d. Proposed cleaning, flushing, testing, disinfection forms
    e. Proposed Static tests and calibration forms
    f. Start-up plan
    g. Proposed functional performance test forms
    h. Completed Manufacturer's installation and start-up documents
    i. Completed cleaning, flushing, pressure testing, disinfection forms
    j. Completed static tests and calibration forms
    k. Completed Contractor Checklists
    l. Completed functional performance test forms
    m. TAB agenda
    n. TAB preliminary and final report
    o. Signed off issues lists
    p. Proposed O&M Manuals
    q. Training plans and agenda
    r. Final O&M Manuals
    s. Contractor Closeout Checklists

4. Develop, manage and update commissioning schedule. Integrate commissioning activities into master schedule. Provide a 2-week look-ahead schedule of commissioning activities, updated weekly or as scheduled commissioning activities change during 2-week period.
5. Distribute issues lists to Contractors responsible for the commissioned systems.
6. Assemble, manage and update the start-up plan.
7. Attend regularly scheduled construction and Owner's meetings and review commissioning activities with Contractors responsible for the commissioned systems and design team. Include commissioning activity items in construction meeting minutes.

8. Participate in and lead commissioning meetings as necessary to coordinate contractor activities in the commissioning process. Meetings are generally to be scheduled once every two weeks during initial construction of commissioned systems, and weekly during start-up and functional test phases. The CxA shall lead commissioning meetings when on site and the CCC shall lead all other meetings.
9. Provide material for, participate in the development of, and review the final report.
10. Coordinate and participate in seasonal testing.

1.10 BACK-CHARGING

A. The Contractor and CCC are responsible to schedule and coordinate installation, start-up and testing activities with the CxA as specified herein and in each section on commissioned systems. Scheduled installation, start-up or testing activities that are not executed because of lack of preparation or coordination by the Contractor that result in unnecessary trips by the CxA are subject to back-charges to the Contractor.

B. Functional testing shall be performed on the systems that are fully complete as reported by the Contractor. Systems that are reprogrammed or have had a software upload that can be shown to invalidate completed functional testing shall be retested to demonstrate proper operation. Tests re-conducted by the Contractor shall be performed at no additional cost to the contract. Tests re-conducted by the CxA shall result in a back-charge to the Contractor.

C. The Contractor shall reimburse the Owner for costs associated with any additional efforts required to witness installation, start-ups, testing activities or for excessive back-checking as indicated above. These costs shall include salary, travel costs and per diem lodging costs (where applicable) for the Commissioning Authority. Rates to be used are listed below:

Per Diem Meals and Lodging:	$150.00/Day (billed at cost)
Salary:	$125.00/Hour

PART 2 – PRODUCTS

2.1 DOCUMENTATION

A. Schedule-A (located at the end of each section on commissioned systems, XX-08-00) contains sample versions of the Contractor Checklists (CCL) to be used for the systems to be commissioned.

B. Schedule-B (located at the end of each section on commissioned systems, XX-08-00) contains a Functional Performance Test Summary Table that outlines each functional test to be conducted for the systems to be commissioned. Part 4 of each section on commissioned systems contain sample versions of functional performance test procedures and data sheets. These do not represent all functional tests that will be required and are intended only to demonstrate the rigor of functional testing required.

C. Paragraph 3.12 contains preliminary versions of the Contractor Closeout Checklists to be used for the systems to be commissioned.

2.2 INSTALLATION VERIFICATION

A. The CxA shall conduct an independent Installation Verification using checklists based on the Contractor Checklists provided in Schedule – A, located at the end of each section on commissioned systems.

2.3 STARTUP FORMS

A. Any installation and start-up checklists that are provided by the manufacturer shall be used in the equipment start-up process. Non-manufacturer developed forms must be approved by the CxA prior to use. Start-up forms must be submitted to the CCC for inclusion in the Start-up plan at least one month prior to system start-up to allow for review and approval by the CxA. Documentation for static testing, cleaning, flushing, calibration and other activities required by project documents are considered start-up forms. Schedule – A (located at the end of each section on commissioned systems) outlines the required documents to be submitted by the Contractor.

2.4 FUNCTIONAL PERFORMANCE TEST FORMS

A. The functional performance test procedures and data sheets shall be developed by the CxA as outlined in Schedule B (located at the end of each section on commissioned systems), with input from the CCC and Contractor as required.

B. The Contractor has specific responsibilities for developing, performing and documenting functional test procedures as directed by the CxA. See Schedule – B for minimum testing and documentation requirements.

C. In addition to the testing outlined in Schedule – B, wherever the Project Documents require testing, test reports, checklists, verifying operation, demonstrating proper operation or other similar language with respect to the systems to be commissioned, written testing procedures and documentation of tests will be required from the Contractor, whether specified or not in the commissioning sections.

D. A tracking document for these submittals is included in Schedule - B which outlines which of these activities will require submittal information by the Contractor. Contractors responsible for the systems to be commissioned and due dates will be determined at the initial commissioning coordination meeting.

2.5 COMMISSIONING ISSUES LIST

A. The CxA shall maintain the Commissioning Issues List. At any time an issue is discovered where the installation or performance of the commissioned system does not meet contract document requirements, an individual issue shall be generated. As issues are resolved and verified by additional inspections or tests, the issues list shall be updated. The issues list shall be a running history of the status of the issue.

2.6 TEST EQUIPMENT

A. Where required, the Contractor shall provide test equipment, whether specified or not, to execute the functional performance tests.

B. The test equipment shall be provided in sufficient quantities to execute functional testing in an expedient fashion.

C. The test equipment shall be of industrial quality and suitable for testing and calibration with accuracy within the tolerances necessary to demonstrate system performance.

D. Equipment shall be certified to an accuracy of 10% of the smallest tolerance to be measured. For example, if a temperature gage is required to be +2 degrees F, the calibration device must have an accuracy of +0.2 degrees F.

E. The test equipment shall have calibration certification per equipment manufacturer's interval level or within one year if not specified.

PART 3 – EXECUTION

3.1 DOCUMENTATION

A. Checklists, start-up documentation, test forms and other commissioning related documentation required by contract shall be neatly and legibly completed and provided to the CxA via the CCC in a clear and easily readable condition.

B. Required checklists, start-up documentation, test forms and other commissioning related documentation shall be provided to the CxA via the CCC in a timely fashion and according to the commissioning and construction schedule.

C. In every case where the Contractor is unable to comply with an item as listed on the checklist or form, the Contractor shall immediately notify the CxA in writing as to the reasons for non-compliance.

3.2 ACCESS TO EQUIPMENT AND SYSTEMS

A. The Contractor shall provide access to all equipment and systems to be commissioned both during construction and after occupancy as necessary. The Contractor shall coordinate with other trades to assure that access to commissioned equipment is available to the CxA and other trades at the proper times and with sufficient duration.

B. The Contractor shall provide all ladders, lifts, scaffolding, access doors, removal/installation of ceiling tiles and any other materials or activities as necessary to allow the CxA to easily access equipment and systems.

C. During the commissioning process, the Contractor shall coordinate the installation of ceiling tiles and other finishes to allow all trades and the CxA to perform their work without having to remove or reinstall ceiling tiles or other finished work. Note that above-ceiling access is required to perform Installation Verification and Functional Performance Testing of systems. Ceiling tiles typically must be in place during Testing and Balancing activities. Since Testing and Balancing may occur between Installation Verification and Functional Performance Testing, some ceiling tiles may require multiple removal/reinstallation cycles.

D. In the event that system commissioning is not fully completed after occupancy, the Contractor shall be responsible for coordinating with the owner for access to the equipment or system for testing, back-checking and other commissioning activities. This requirement shall include providing access to equipment as indicated above.

3.3 MEETINGS AND SITE OBSERVATIONS

A. Commissioning status meetings shall be scheduled to occur during the construction and closeout phase to monitor progress and to help facilitate the commissioning process. Contractor representatives for commissioned systems shall be required to attend these meetings. Meetings will generally be scheduled to occur with scheduled construction or management meetings. The CCC shall schedule, coordinate and lead the meetings including providing meeting minutes. These meetings can coincide with, or be a subset of, the normal subcontractor meetings. When the CxA is on site for commissioning duties or scheduled meetings, the CxA shall lead the commissioning meetings and prepare and distribute minutes.

B. Commissioning shall be included in the general construction and Owner's meetings. The CCC will attend these meetings and discuss commissioning related topics there. Commissioning information and issues shall be documented in the meeting minutes.

C. The CxA may perform periodic site visits during construction to monitor commissioning activities. The purpose of these observations will be to evaluate compliance to contractual obligations such as cleanliness, capping ductwork, access to equipment, maintainability and so forth to identify concerns before they are repeated throughout the project. Any issues identified will be noted on a Site Observation Report. The Contractor shall review these reports and take action to resolve issues as needed and deemed appropriate in consultation with the Owner, CxA, and Design Team..

3.4 CONTROLS INTEGRATION MEETING – BUILDING AUTOMATION AND LIGHTING

A. The controls integration meetings (CIM) shall be conducted after the building automation and lighting controls submittals are complete and the CxA has reviewed the submittals. The meetings are to be conducted prior to finalizing the functional test procedures and shall be attended by the CxA, the BAS control contractor, the VRF control contractor, the lighting controls contractor, the mechanical/electrical engineers and a representative of the Owner's maintenance group at a minimum. The CIM shall include, but not be limited to, the following topics:

1. Sequence of Operations
2. Alarm Points List
3. Trend Points List
4. Displayed/Adjustable Point List
5. Graphical Interface
6. Integration with packaged equipment
7. Lighting control interface
8. Point-to-Point Checkout and Commissioning of Existing Equipment
9. Method of Conducting Cx Functional Testing

3.5 PRE-STARTUP ACTIVITIES

A. The CxA shall develop a preliminary commissioning plan with input from the Contractors via the CCC.

B. As soon as possible after the bid award, approval of submittals and development of the preliminary commissioning plan, the CxA shall conduct an initial commissioning coordination meeting with the CxA, CCC, Contractors, Owner's Representative and the A/E Team. The CxA will explain the commissioning process in detail, and identify specific commissioning related responsibilities. The preliminary commissioning plan shall be provided to the Contractors at this time. The requirements for submittal material shall be reviewed along with a preliminary schedule of commissioning activities.

C. The Contractor shall submit to the CxA via the CCC preliminary O&M manuals prior to developing the Start-up and Commissioning Plan by the CxA.

D. The Contractor shall submit to the CCC the proposed start-up and Contractor required testing documentation for assembly into the Start-up and Commissioning Plan by the CxA.

E. The CxA shall develop a Start-up Plan based on Contractor submittals and the start-up requirements of the contract documents. It details the procedures and forms for individual pieces of equipment and systems that have start-up and testing requirements. It shall be a three-ring binder indexed by system or equipment. The binder shall be populated with procedures and blank forms and used to file the completed forms as the procedures are completed by the Contractor. The Start-up Plan shall include, but is not limited to, the following:

1. List of commissioning team members.
2. Start-up document tracking forms.
3. Master list of equipment/systems for installation and start-up.
4. Start-up and static testing schedule.
5. Manufacturer and Project Document required installation, start-up and testing procedures
6. Blank copies of start-up and testing forms for each type of equipment/system.
7. Contractor checklists for each system.

F. The CxA shall develop the final commissioning plan. The commissioning plan typically includes, but is not limited to, the following:

1. Project overview.
2. Commissioning Authority scope of work.
3. Contractor's Commissioning Coordinator scope of work.
4. Roles and responsibilities of commissioning participants.
5. A schedule with sequential description of commissioning activities.
6. A complete list and description of equipment and systems to be commissioned.
7. The Start-up Plan
8. Installation verification data forms for systems and equipment to be commissioned.
9. Functional performance test criteria, test forms and data forms for systems and equipment designated to be functionally tested including trending needed for the performance period.
10. System integration testing plan.
11. Sample commissioning issues list.

12. Project closeout activities

G. The Contractor shall be responsible for the liability and safety of conducting tests. The CCC and Contractor shall review the Functional Performance Test (FPT) documents provided by the CxA prior to including them in the final commissioning plan. The Contractor is to review preliminary and final test procedures to verify that they:

1. Will not pose a risk of injury to any personnel.
2. Will not pose a risk of damage to equipment, structure or any physical element of the building.
3. Will not negate any equipment or system warranties.
4. Are executable with the personnel and equipment available to the Contractor.

3.6 EQUIPMENT INSTALLATION AND START-UP

A. Installation and Start-up activities include procedures outlined by the contract documents and the equipment manufacturer including cleaning, static testing, calibration and other related activities. The CxA shall provide the Contractor with a start-up plan based on Contractor submitted procedures and checklists.

B. The CxA may witness selected equipment start-up and testing performed during construction. The CCC shall keep the CxA informed of commissioning activities with regular status reports and updates to the commissioning plan, start-up plan and schedules

C. The Contractor shall perform equipment start-up per the approved start-up plan and start-up forms. The Contractor shall correct issues as they are discovered. The Contractor shall complete the installation and start-up forms as the work is complete and place the fully completed installation and start-up forms in the start-up binder.

D. Upon completing the start-up activities for a given system, the associated Contractor Checklists (CCL) shall be completed by the Contractor and placed in the appropriate tab section of the start-up binder. The CCL is used as a cover form for the individual equipment manufacturer's recommended start-up forms for each system. The completed CCL is the Contractor's certification that they have completed all required installation and start-up activities and the system is ready for installation verification by the CxA and subsequent functional performance testing.

E. The start-up binder shall be maintained by the Contractor's Commissioning Coordinator. The Contractor is responsible for maintaining the start-up book in good order and to turn the completed document over to the CxA at the conclusion of start-up. If the start-up binder is lost or stolen, it shall be the responsibility of the Contractor to recreate the binder and its contents, including re-conducting start-up activities if necessary.

F. Upon completion of all start-up activities including the required documentation, the Contractor shall submit the start-up binder to the CxA via the CCC for review and approval.

3.7 INSTALLATION VERIFICATION (IV)

A. The IV process shall begin when signed off CCLs and start-up documents are received from the Contractor.

B. The CxA shall conduct an independent installation verification audit on selected systems to verify conformance with manufacturer's installation instructions and project documents. The CxA shall use the completed CCL from the contractor to verify installation. Discrepancies discovered will be reported on the Commissioning Issues List by the CxA. A copy of the issues list will be transmitted to the Contractor via the CCC with a copy to the Owner and Design Team.

C. The Contractor shall correct any issues discovered and note the action taken on the issues log and return it to the CxA via the CCC.

D. The CxA shall back-check and verify that the issues are resolved prior to proceeding with FPT.

3.8 FUNCTIONAL PERFORMANCE TESTS (FPT)

A. FPT includes the documented testing of system parameters, under actual or simulated operating conditions. Final performance testing of systems will begin only after the Contractor certifies that systems are 100% complete and ready for functional testing, by providing completed and signed-off copies of the start-up plan and providing completed Contractor Checklists.

B. Any testing procedures and forms which the Contractor is required to provide must be provided by the CCC to the CxA at least one month prior to start of installation of the equipment and as needed to complete the commissioning plan.

C. Functional performance testing of commissioned systems shall begin after all critical issues discovered during the start-up and installation verification process have been corrected. The CxA and Contractor shall conduct functional performance tests on selected systems to verify functional performance criteria as outlined in Schedule - B (located at the end of the individual divisional commissioning specifications) and as required in the Project Documents and approved by the CxA in the Commissioning Plan. Discrepancies discovered will be reported on the Commissioning Issues List by the CxA. A copy of the issues list will be transmitted to the Contractor via the CCC.

D. Functional tests that have excess failure rates or are aborted due to lack of Contractor participation or scheduling are subject to the back-charging provisions of the paragraph Back Charging.

E. The Contractor shall make available to the CxA a method of interfacing with any commissioned control systems at the building site including but not limited to the building automation system, packaged control systems, programmable logic controllers and lighting control systems. This interface shall be made available regardless of whether or not a permanent local work station is specified elsewhere in the contract documents. The on-site interface shall be made available from the time of completion of start-up activities until trending is complete and all commissioned systems are accepted by the owner. The Contractor shall also make available to the CxA a method of remote access to the control system(s) beginning at the time of completion of start-up activities and extending for one year after system acceptance. Remote and local access shall include all software, licensing, software keys and anything else required to facilitate full access to the system(s). The local and remote interfaces shall include all contract required interfaces including, but not limited to, all graphics, trends and alarms. The CxA shall be given an account with full security access privileges to the system(s).

3.9 COMMISSIONING ISSUE DOCUMENTATION AND CORRECTION

A. The commissioning issues list is generated and maintained by the CxA to include a description of the issue, date of posting, the current status of issues, assignment to the responsible party and the date of final resolution as confirmed by the CxA. Items listed may include issues where design, products, execution or performance does not appear to satisfy the Contract Documents and the design intent. The resolution of issues identified on this list may or may not be the responsibility of the Contractor.

B. Once issues have been identified and assigned to a Contractor on the Commissioning Issues List, the Contractor shall be required to investigate and resolve these issues in a timely manner. After correcting issues noted on the Commissioning Issues List, the Contractor shall sign off on each issue and return the list to the CxA via the CCC for initiation of back-checking by the CxA.

C. In the event that an issue has been assigned to the wrong Contractor or resolution of the issue requires multiple trades, Contractor with the initial assignment shall take the lead in working with the CCC and CxA to reassign the issue or coordinating the multiple trades to resolve the issue.

D. The CxA shall back-check and verify that the commissioning issues are resolved and update the issues list. Excessive back-checking by the CxA due to issues reported as complete not actually being resolved are subject to the back-charging provisions of the paragraph Back Charging.

3.10 PERFORMANCE PERIOD

A. Performance Period: The performance period is a set length of time designated to demonstrate proper facility operation prior to acceptance. The performance period commences after successful completion of all functional testing. Parameters evaluated for heating and ventilation systems typically include zone temperature stability, optimum start/stop, warm-up period and other related functions. For lighting control the parameters include lighting levels, occupancy switching and daylight control. As part of this process the Contractor will be required to set up and provide trends of building automation system parameters per the direction of the CxA. The specific trending needed will be outlined in the commissioning plan, the Contractor should assume that all points in the building automation system will be trended. Lighting control parameters will be trended if system capabilities exist, otherwise the Contractor will provide stand-alone data loggers to demonstrate operation of systems.

B. The CxA shall prepare a performance period test plan including measured variables and success criteria based on performance characteristics described in the Project Documents. The CxA will provide the Contractor with a list of trend log definitions or stand-alone data logger requirements based on the performance period test plan included in the Commissioning Plan.

C. The Contractor will review the performance period test plan and set up the trend log definitions and stand-alone data loggers. Trend logs shall be set up for all inputs/outputs, both digital and analog, for all points in the system both physical and virtual. Trend interval shall be 5 minutes unless otherwise directed by the CxA. The minimum trend period shall be 14 days. Trend log point headings as displayed on system graphs and data tables shall be adequately descriptive for the point but no longer than 12 characters unless approved by the CxA. System default names are not acceptable. The heading titles shall contain no extraneous characters that are not needed to describe the point. The contractor shall provide the trends to the Commissioning Authority in

electronic format, in MS Excel or a comma delimited file with related system parameters grouped together for easy comparison. If building automation system resident memory is limited or there are other issues with the trending requirements, the Contractor will work with the CxA to redefine the test plan.

D. The performance period will commence within one week of the final functional tests and run for a minimum of 14 days. A similar performance period may be required for seasonal testing. If failures are encountered, the performance period shall be aborted. After corrections are made, the performance period shall be re-started at day one. Systems shall run per the final sequences of operation for 30 days without adjustments or corrections before the warranty period will commence.

3.11 SEASONAL TESTING

A. Seasonal testing is required to demonstrate the system's ability to meet design conditions associated with seasonal extremes, typically peak heating and peak cooling conditions.

B. Seasonal testing may also be required when ambient conditions will not support the operation of specific equipment.

C. Seasonal testing is required to demonstrate the performance for a fully occupied building or portion of the building as well as for systems that are occupancy sensitive.

D. The Contractor shall provide labor and material for seasonal testing and make corrections to any Contractor related issues discovered.

3.12 PROJECT CLOSEOUT

A. Post construction Contractor responsibilities include completion and submission of the Project Closeout Checklist for each commissioned system to the CxA for verification of completing contracted obligations for the owner. Sample project closeout requirements, tracking sheet and checklists are included herein. The Contractor is free to submit alternate formats for review and approval by the Owner, Design Team and CxA as appropriate.

B. Upon request, the Contractor is responsible for providing the CxA with copies of the balancing reports, as-built drawings, O&M manuals relevant to the systems commissioned and the Contractor provided material required for the Systems Manual. The CxA shall review this material for compliance with Project Documents and report issues for resolution by the responsible party.

C. Upon completion of commissioning activities the CxA will prepare and submit to the owner the Final Commissioning Report detailing the commissioning plan and commissioning activities and recommending acceptance to the Owner. The CCC will support this effort by coordinating the Contractor provided documentation.

D. Training on related systems and equipment operation and maintenance shall only be scheduled to commence after functional testing is satisfactorily completed, O&M manuals have been delivered and approved, the Systems Manual is complete and systems are verified to be 100% complete and functional. Each Contractor is responsible to provide a topical outline of the subjects to be covered in the training session(s), the expected length of time for the training sessions, and a brief resume

listing the qualifications of the proposed training presenters. The CCC is responsible for developing the training plan with input from the Contractor and directing any video taping efforts. The training plan is to be submitted to the Owner, Design Team and CxA for approval prior to conducting training. The CCC is responsible for coordinating training with the Owner and CxA and to verify execution of the training plan.

E. Contractor Project Closeout Checklists are included in this section. The Contractor responsible for the delivery of each of the listed systems in the Project Closeout System Summary Table below shall be responsible for completion of a Project Closeout Checklist for that system. The checklists included within this Schedule are sample versions and are only representative of what shall be included in the final Commissioning Plan. The Contractor is responsible to demonstrate compliance with all closeout requirements and the final checklists may contain additional requirements to document this compliance. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents except as noted below regarding developing training plans.

F. Training Plans: For all Owner instruction, the Contractor shall submit a training plan for each system identified in the Project Closeout System Summary Table below, for review and approval by the Commissioning Authority and the Owner. Training shall not proceed without approval of the training plan. A sample training plan is included following the sample Project Closeout Checklist. The training plan must contain the following as a minimum:

1. Attendee sign-off sheet.
2. Required training hours specified in the project documents.
3. Detailed list of subject to be covered and durations.
4. Qualifications of training provider.
5. Training schedule including duration of each training session.

Project Closeout System Summary Table

A System Description	B Responsible Contractor	C Proposed Agenda Received	D OK	E Training Performed	F OK	G Closeout Form Received	H OK	I Notes
Division 11 Systems								
Walk-in Freezers and Coolers								
Division 20 Systems								
Balancing Air and Water								
Division 21 Systems								
Fire-Suppression Systems								
Division 22 Systems								
Hot Water Heaters/Pumps								
Division 23 Systems								
Dedicated Outdoor Air Units								
VRFZ System								
Split System AC								
Make up air unit								
Kitchen exhaust								
Unit heaters								
Paddle fans								
Air Distribution System								
VRFZ Control System								
Division 25 Systems								
Energy Management and Control System								

A	B	C	D	E	F	G	H	I
Division 26 Systems								
Daylight Dimming/Switching								
Occupancy Sensors								
Lighting Control System								
Division 28 Systems								
Fire Alarm								

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing project closeout and training. To be filled in after contract award.
C. Date the proposed training agenda is received from the responsible Contractor.
D. Indicates that the CxA and Owner has received and approved the proposed training agenda.
E. Date the training was performed.
F. Indicates that CxA and Owner has approved the training provided.
G. Date the completed Contractor Closeout Checklists are received from the responsible Contractor.
H. Indicates that the CxA has approved completed Contractor Closeout Checklists.
I. Notes on status of forms, irregularities and rework needed.

SAMPLE DOCUMENT - Contractor Closeout Checklist

System: _____

Instructions:
Contractor shall complete all specified items as listed on the following checklist and return the signed checklist to the Commissioning Authority via the Contractor Commissioning Coordinator prior to substantial completion. In addition, the Contractor may be required to demonstrate compliance with specified criteria on-site, as deemed appropriate by the Commissioning Coordinator or Commissioning Authority.

Project Closeout Checklist:

Instruction:
☐ Owner instruction is complete per project documents.

Warranty and Spares:
☐ Warranty has been provided with operations and maintenance manuals.
☐ All spares have been submitted to owner and receipt of materials signed.

Documentation:
☐ O&M Manuals are complete and submitted.
☐ As-built drawings, material list, technical literature, list of recommend spare parts, system description, and sequence of operation have been updated and included in the O&M manuals.

Final Acceptance:
☐ Final performance testing completed and system accepted by owner, CC and CxA.

Please note: This checklist is not intended to represent all the requirements of the Project Documents within this section. Completion of the items on this checklist does not release the Contractor from their contractual obligation to complete all the work as detailed within the entire specification section.

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
General Contractor CC:			

SAMPLE DOCUMENT - Operation and Maintenance Training Agenda

Equipment / System: _____

SECTION 1 Filled out by the project Owner, submit to contractor
SECTION 2 Contractor to indicate Trainer and credentials
SECTION 3 Contractor to indicate proposed Agenda and Topics.

SECTION 1 – Audience and General Scope

Description	Check all that applies
Intended Audience	
Facility Manager	
Facility Engineer	
Facility Technician	
Project Manager	
Tenant	
Other	
General Objectives and scope of training	
Provide an overview of the purpose and operation of equipment, including required interactions with trainees.	
Provide technical information regarding the purpose, operation and maintenance of equipment at an intermediate level expecting that some support from outside contractors will be provided as needed.	
Provide technical information regarding the purpose, operation, troubleshooting and maintenance of equipment at a detailed level expecting that most operational and maintenance, service and repair will be conducted by trainees.	

Use blank spaces to describe additional/other objectives for the training session as needed.

SECTION 2 – Credentials - Trainers/Instructors & Photographer

Company	Trainer/Photographer	Position/Qualifications

SECTION 3 – Agenda and Training Topics

Description	Indicate covered items	Duration (min.)	Trainer	Complete
General purpose of the equipment/system (design intent).				
Review of drawings and schematics.				
Review start-up, loading, operation, unloading, shut-down, occupied/unoccupied operation, seasonal change-over procedures as applicable.				
Review building automation control interface, set points, schedules, alarms, graphical interface as applicable.				
Review unitary (packaged) controls, programming, troubleshooting, alarms, and manual operation procedures as applicable.				
System interface with other systems – fire alarm, emergency power system, and other systems as applicable.				
Energy conservation strategies as applicable.				
System/equipment troubleshooting methods, procedures, error messages as applicable.				
Service, maintenance, preventive maintenance procedures.				
Spare parts provided and suggested.				
Special requirements to maintain warranty.				
Special procedures related to tenant interface with the system.				
Health and/or safety issues as applicable.				
Use of O&M manuals.				
Use of as-built drawings, plans and/or schematics.				
Discussion/lecture.				
Site demonstration of equipment operation.				
Written handouts.				
Manufacturer training manuals.				
Video presentation.				
Question and answer session.				
Training session to be taped for owner’s future reference and training requirements.				

Use blank spaces to fill in any additional/other subjects covered.

SAMPLE DOCUMENT - Training Session Attendee Roster

Equipment / Session: _____

Training Date: _____

Attendees	Organization

3.13 NEAR-WARRANTY-END REVIEW

A. Approximately two months prior to the end of warranty on commissioned systems, the Contractor shall participate in a review of the commissioned systems with the owner, design team and the CxA to identify any operational and outstanding issues. For this review, the Contractor shall schedule the attendance of appropriate parties with project specific knowledge, including but not limited to the following:

General Contractor
Mechanical Contractor
Building Management System Contractor
Variable Refrigerant Flow System Startup and Controls Contractor(s)
Lighting Controls Contractor(s)

B. The review shall consist of a meeting on site with the Contractor with follow up testing and verification by the Contractor.

C. A list of issues will be developed by the owner and CxA. Once issues have been identified, the Contractor shall investigate, test and inspect systems as necessary to identify and resolve warranty issues in a timely manner.

D. The Contractor shall ensure the cooperation of appropriate Contractors responsible for the commissioned systems in any follow-up meetings, testing, inspections and investigation regarding warranty issues and in resolving, prior to the end of the warranty, any warranty issues discovered.

E. Issues identified in this review will remain warranty items until satisfactory completion, even if the warranty period expires during the review and correction period.

END OF SECTION 019113

SECTION 022200 - EXISTING SITE CONDITIONS

1.1 SUMMARY

A. Section Includes: Information on topographic site survey.

1.2 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this section.

B. Topographic Survey, dated August 22, 2016, by Axis Survey and Mapping, Inc.

C. Field Report, dated November 2, 2017, by Associated Earth Sciences Incorporated, attached, regarding soil stockpile in parking lot P-5.

D. Asarco testing to comply with Washington Department of Ecology's SEPA review; WSH has completed testing and results will be provided as soon as possible.

1.3 BIDDING REQUIREMENTS

A. Contractor shall review the project site, the site conditions and the routes of travel to the site.

1.4 DISCLAIMER

A. Survey is provided without warranty as to their accuracy or completeness and is intended only as a general reference to probable site conditions.

B. No individual or entity shall be responsible for any interpretation or conclusions drawn by Bidder from information furnished.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 022200

associated
earth sciences
incorporated

911 Fifth Avenue
Kirkland, Washington 98033
Phone: 425-827-7701
Fax: 425- 827-5424
www.aesgeo.com

FIELD REPORT

Date	Project Name		Project No.
11/2/2017	Western State Hospital		040805E001
Location		**Municipality**	**Weather**
9601 Steilacoom Blvd. SW		Lakewood	Cloudy 55°F
Permit No.	**DPD No.**		**Report No.**
			1
Engineer/Architect			
Coughlin Porter Lundeen / NAC Architecture			
Client			
NAC Architecture			
General Contractor/Superintendent			
N/A			
Grading Contractor/Superintendent			
N/A			

TO: NAC Architecture
2025 1st Avenue, Suite 300
Seattle, WA 98121
ATTN: Cheryl Jacobs

AS REQUESTED BY: Cheryl Jacobs

THE FOLLOWING WAS NOTED:

Stockpile

Associated Earth Sciences, Inc. (AESI) arrived onsite in the am to observe a stockpile of soil located at the northwest corner of the hospital campus in a parking lot near the intersection of West Street and Sentinel Drive. The stockpile is at the northwest corner of the parking lot and was not covered. We understand that the stockpile was generated from the grading of another parking area somewhere on the hospital campus. The soil generally consisted of brown to dark brown, sandy gravel with trace silt. The stockpile was approximately 6.5 feet high with a flat top and approximately 120 feet long. With a shovel and a few five-gallon buckets AESI took several samples of the stockpile from different locations in order to get representative samples. The samples were taken back to our laboratory for two sieve analyses and two proctor test.

Based on our visual observations and laboratory testing the stockpiled soils are suitable for use as structural fill, in our opinion. The results of our sieve analyses show that the fine-grained content, material passing the #200 sieve, of the soil ranges from 9.5 to 10.4 percent and therefore, the material is moderately moisture sensitive and can become too wet to achieve proper compaction if exposed to weather. We recommend that the stockpile is covered with plastic which is anchored down by sandbags.

Note: Environmental testing was beyond our scope of work. Our opinion is strictly based from a geotechnical standpoint.

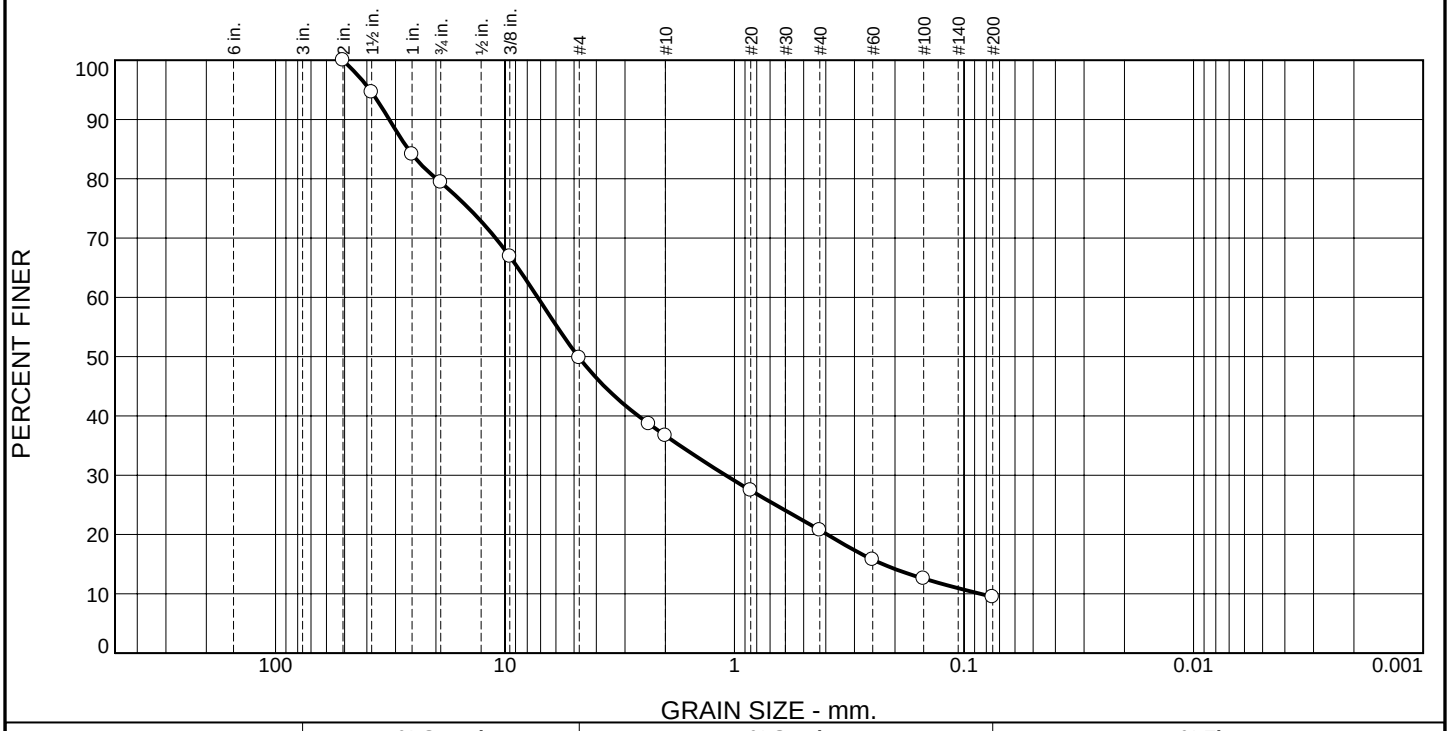
Attachments: Laboratory Results

Copies To: _____ Field Rep: Tony Romanick, P.E.

Date Mailed: _____ Principal / PM: Kurt Merriman, P.E. / Tony Romanick, P.E. TR

This document is considered a DRAFT until signed or initialed by an AESI Principal or Project Manager

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.6	29.6	13.1	16.0	11.2	9.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	94.6		
1	84.1		
.75	79.4		
.375	66.9		
#4	49.8		
#8	38.7		
#10	36.7		
#20	27.4		
#40	20.7		
#60	15.8		
#100	12.6		
#200	9.5		

* (no specification provided)

Material Description

very sandy, GRAVEL, some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GW-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 31.9426 D_{85}= 26.4114 D_{60}= 7.2038
D_{50}= 4.7909 D_{30}= 1.0936 D_{15}= 0.2261
D_{10}= 0.0851 C_u= 84.69 C_c= 1.95

Remarks

Collected by: TR

Date Received: 11-3-2017 **Date Tested:** 11-8-2017

Tested By: BN

Checked By: TR

Title:

Location: Onsite- east end of parking lot stockpile

Date Sampled: 11-3-2017

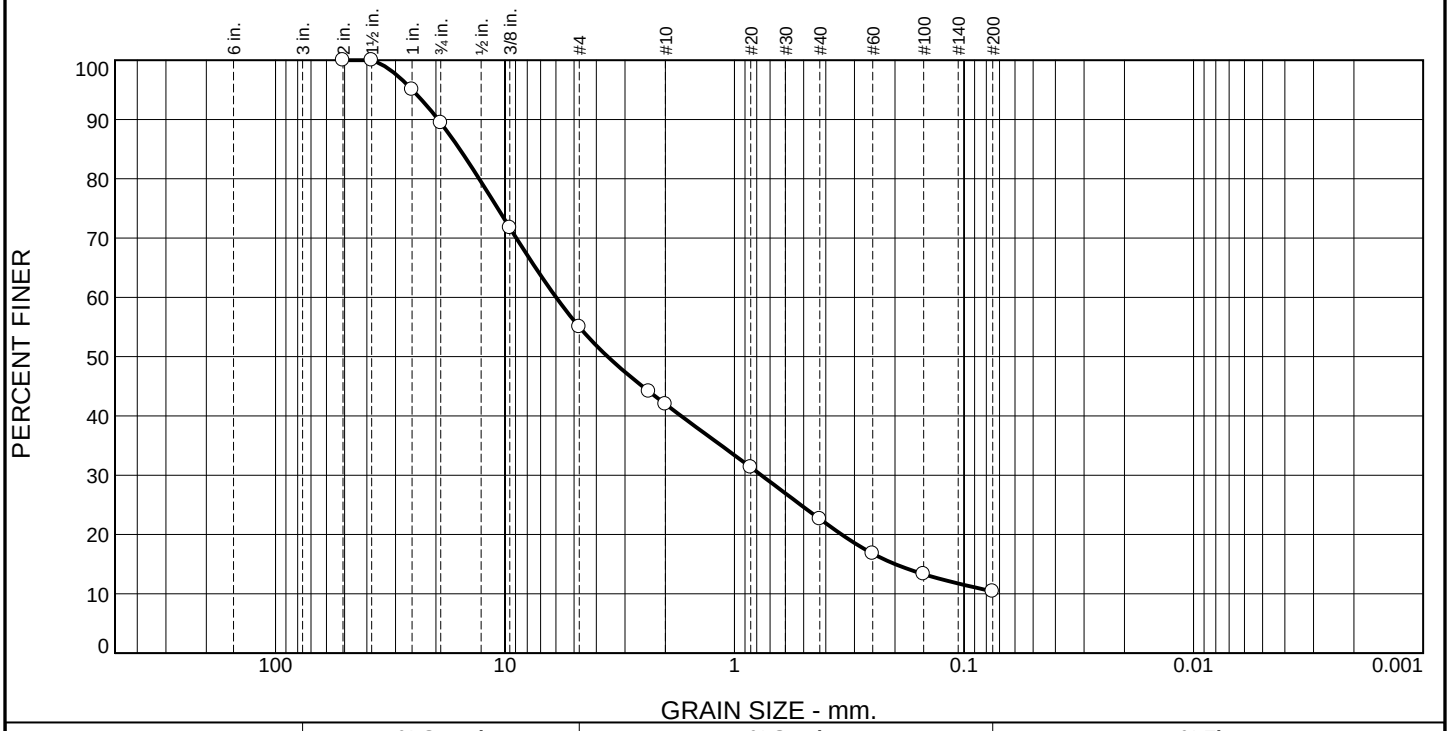
associated earth sciences incorporated

Client: NAC Architecture

Project: Western State Hospital

Project No: 040805 E001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.6	34.4	13.0	19.4	12.2	10.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1.5	100.0		
1	95.0		
.75	89.4		
.375	71.7		
#4	55.0		
#8	44.1		
#10	42.0		
#20	31.3		
#40	22.6		
#60	16.8		
#100	13.3		
#200	10.4		

* (no specification provided)

Material Description

very sandy, GRAVEL, some silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= GP-GM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 19.5512 D_{85}= 15.7503 D_{60}= 5.9883
D_{50}= 3.5700 D_{30}= 0.7640 D_{15}= 0.1995
D_{10}= C_u= C_c=

Remarks

Collected by: TR

Date Received: 11-3-2017 **Date Tested:** 11-8-2017

Tested By: BN

Checked By: TR

Title:

Location: Onsite- west end of parking lot stockpile

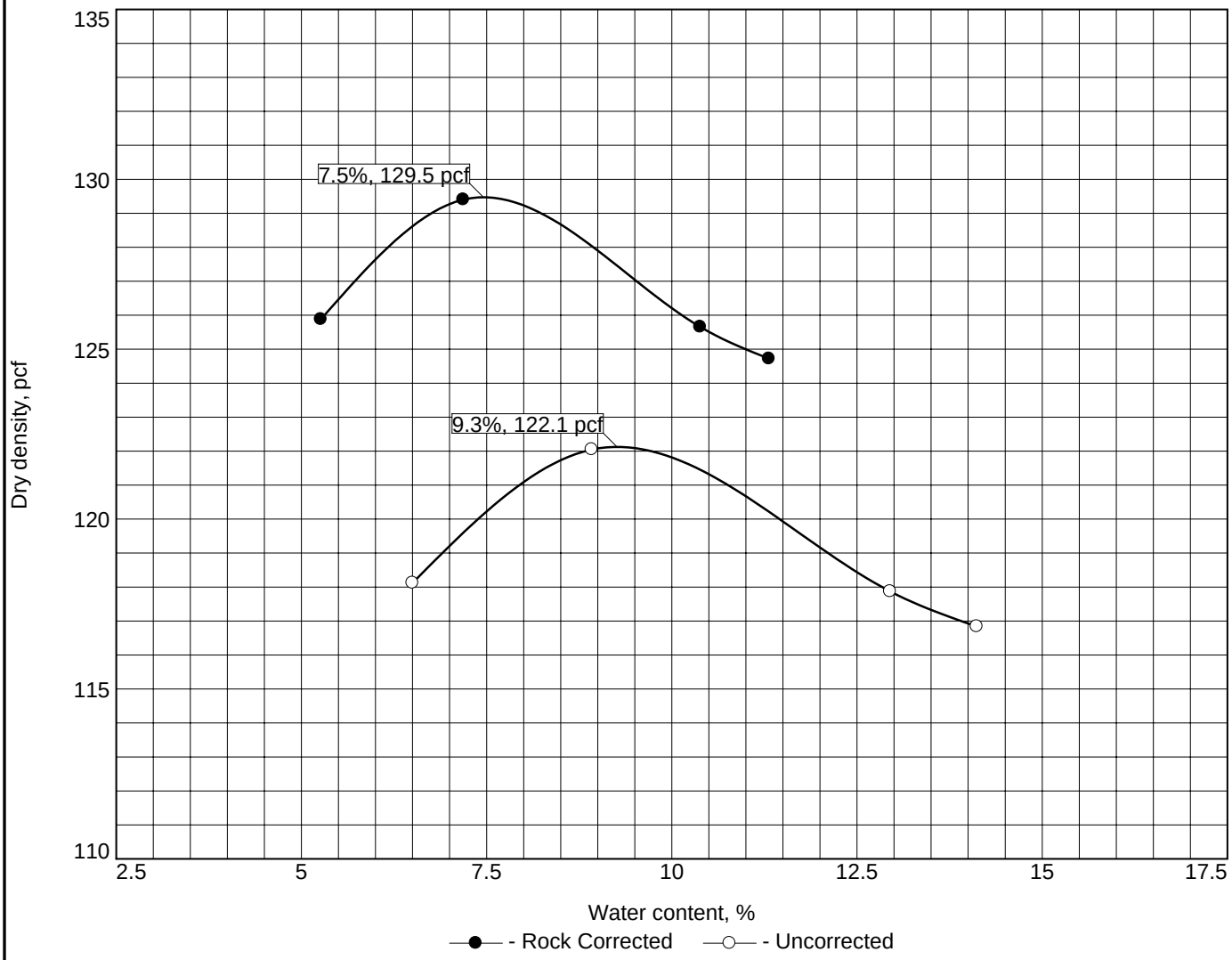
Date Sampled: 11-3-2017

associated earth sciences incorporated

Client: NAC Architecture

Project: Western State Hospital

Project No: 040805 E001 **Figure**



Test specification: ASTM D 1557-91 Procedure C Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GW-GM	A-1-a			NV	NP	20.6	9.5

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 129.5 pcf	122.1 pcf	very sandy, GRAVEL, some silt
Optimum moisture = 7.5 %	9.3 %	

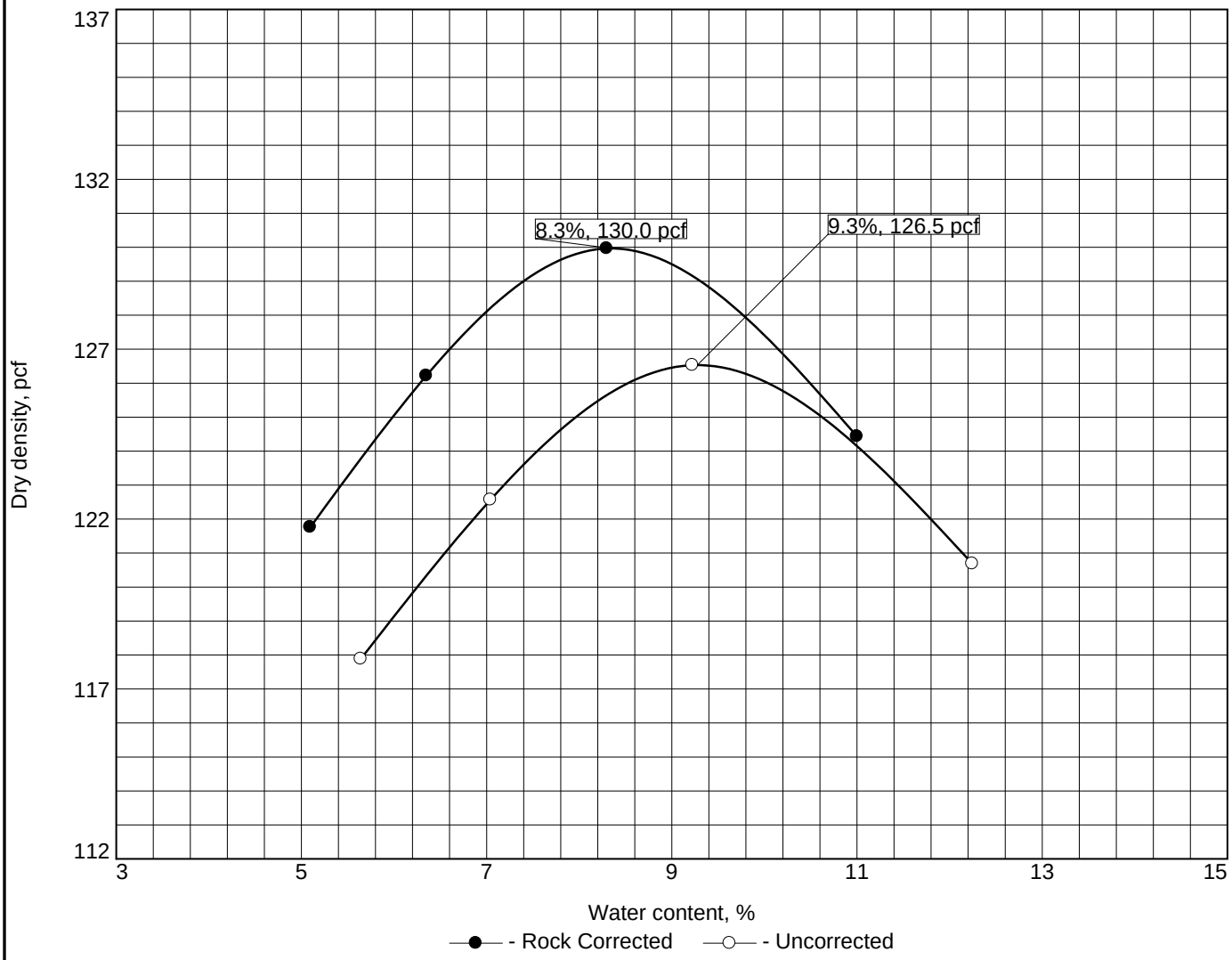
Project No. 040805 E001 **Client:** NAC Architecture
Project: Western State Hospital
Date: 11-6-2017
○ **Location:** Onsite- east end of parking lot stockpile

associated earth sciences incorporated

Remarks:
Collected by: TR

Figure

Tested By: BN **Checked By:** TR



Test specification: ASTM D 1557-91 Procedure C Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GP-GM	A-1-a			NV	NP	10.6	10.4

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 130.0 pcf	126.5 pcf	very sandy, GRAVEL, some silt
Optimum moisture = 8.3 %	9.3 %	

Project No. 040805 E001 **Client:** NAC Architecture
Project: Western State Hospital
Date: 11-7-2017
○ **Location:** Onsite- west end of parking lot stockpile

associated earth sciences incorporated

Remarks:
Collected by: TR

Figure

Tested By: BN **Checked By:** TR

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures and finishes for the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Elevated slab on metal deck.
4. Retaining walls.
5. Access ramps and walkways.
6. Waterstops.

B. Related Sections:

1. Division 01 “Sustainable Requirements.”
2. Division 03 Section “Architectural Concrete Finishing” for finishing of exposed concrete slabs at selected areas.
3. Division 07 Section “Bituminous Dampproofing” for coatings on concrete surfaces below grade.
4. Division 07 Section “Sheet Waterproofing” for bentonite waterproofing at footings and foundation walls adjacent to occupied areas.
5. Division 07 Section “Water Repellents” for sealing typical concrete walls.
6. Division 07 Section “Thermal Insulation.”
7. Division 07 Section “Below-Grade Vapor Retarders”.
8. Division 07 Section “Joint Sealants” for sealing concrete joints.
9. Division 31 Section “Earthwork” for drainage (capillary break) fill under slabs on grade.
10. Division 32 Section "Concrete Paving" for concrete pavement and walks.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Refer to General Structural Notes for requirements.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Show all wall elevations.

D. Laboratory test reports for concrete materials and mix design test.

E. Welding certificates. Welders shall be WABO or AWS certified.

F. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Provide mix submittal highlighting the extent of fly ash replacement, including dollar value.

B. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

C. Cut sheets or other documentation for each product/material highlighting recycled content information.

D. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
4. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. Concrete Testing Service: Comply with provisions of Division 01 Section "Quality Requirements" and Division 01 Section "Testing and Inspection Services".

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

D. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor’s superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORMING SYSTEM

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Form for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOC’s) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCMENT

A. Reinforcing Bars: ASTM A 615, Grade as indicated in “General Structural Notes” on drawings.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

C. Fly Ash: ASTM C 618, Type F. 15-45% of the cement mix.

D. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. and as specified. Provide aggregates from a single source for exposed concrete.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

F. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

G. Water: ASTM C 94/C 94 M and potable.

H. Concrete Strength: See General Structural Notes for required minimum strengths for structural concrete members. Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency for preparing and reporting proposed mix designs.

I. Mixes shall be proportioned so as not to exceed the maximum slumps indicated.

J. Water-Cementitious Material Ratio: See General Structural Notes.

K. Shrinkage-Reducing Concrete: **Concrete mixes for members exposed upon their final condition** shall be proportioned such that the **slab drying shrinkage shall not exceed 0.03% at 90 days** (laboratory conditions). Submit strength and shrinkage test data and mix design to the architect and structural engineer for review a minimum of two weeks prior to placing any concrete.

1. Water-Cement Ratio: 0.40 maximum
2. Strength: Per General Structural Notes
3. Aggregate: Gradation well proportioned and distributed with largest topsize coarse aggregate of ¾ inch.
4. Fly Ash or Slag: Maximum 15%
5. Testing: Trial mixtures tested for shrinkage reduction prior to construction
6. Admixtures: See approved admixtures in section below.

L. Admixtures:

1. General: Provide concrete admixtures that contain not more than 0.05 percent chloride ions.
2. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

a. Use air-entraining admixture in exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
b. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure: 5 to 7 percent air unless indicated otherwise in Structural Notes.
c. Other concrete not exposed to freezing, thawing or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

3. Water-Reducing Admixture: ASTM C 494, Type A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
4. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
5. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
6. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.
7. Shrinkage-Reducing Admixture: Eclipse Floor 200 (by Grace Concrete Products) or Tetraguard AS20 (by BASF) proportioned in accordance with manurfacturer's specifications to meet required maximum drying shrinkage requirements listed above.

a. Dosage: For bidding purposes only, assume 1.5 gallon of admixture per cubic yard of concrete. Final optimum dosage and mix design shall be determined by the concrete supplier/manufacturer based on testing prior to construction.
b. Admixture volume shall replace equal volume water.
c. Water-reducing admixtures: Use only near neutral setting polycarboxylate-based water-reducing admixtures that are compatible with shrinkage-reducing admixtures listed above.
d. Site-mixing of admixtures not allowed.

2.5 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products or approved:

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.
d. Progress Unlimited, Inc.; Superstop.

2.6 WATER CURING MATERIALS

A. Conform to ACI 308, 2.2 – Water Curing methods. Sheet curing procedures except as otherwise accepted by Architect.

B. Sheet Curing Materials:

1. Kraft Curing Paper: ASTM C 171, Type 1.1.1.2, two sheets of reinforced kraft paper cemented together with bituminous adhesive with one white reflective surface, non-staining, moisture retentive.
2. Polyethylene Curing Film: ASTM C 171 Type 1.1.2.2, 10 mil thick, opaque white on one side.
3. White Burlap-Polyethylene Sheeting: ASM C 171 Type1.1.3, burlap with 10 mil opaque white polyethylene coating.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Interior Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 **or** aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

1. Acceptable Products:

a. Epoxy Sealant: Vexcon, Power Coat Epoxy Flexible Joint Sealant, Web Site http://www.vexcon.com
b. Polyurea Sealant: VersaFlex, SL/75, Web Site http://www.versaFlex.com.
c. Curecrete CreteFill Pro 85 MI (Addendum 3)

2. Backer Rod: As instructed by manufacturer.

C. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

E. Bonding Agent: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for general bonding of freshly mixed concrete to hardened concrete in accordance with General Structural Notes.
2. See General Structural Notes for epoxy adhesive to be used for grouting of dowels, anchor rods, etc. where specified.

2.8 PROPORTIONING AND DESIGNING MIXES

A. Design mixes to provide normal weight concrete to comply with requirements indicated in “General Structural Notes” on the drawings.

B. Slump Limits: as indicated in “General Structural Notes.”

C. Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect and Structural Engineer.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

F. Alkalinity: Concrete supplier and installer are responsible for providing a slab that meets the criteria below, including remediation if necessary.

1. Slab shall have measured pH ranging between 9 and 10 or as required by flooring manufacturer, whichever is more stringent.
2. Tests shall be performed as specified in Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing.”

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified in the General Structural Notes.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Not permitted without prior approval from Architect.

C. No water shall be added to concrete mix on site.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

a. Class A, 1/8 inch for smooth-formed finished surfaces.
b. Class B, 1/4 inch for rough-formed finished surfaces.

C. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

E. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Forms for Slabs: Set edge forms, bulkheads and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.3 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer’s instructions.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.5 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.6 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.7 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

D. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

E. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
2. Place construction joints perpendicular to main reinforcement. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Structural Engineer. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements. Provide additional reinforcement at construction joints per Structural Drawings.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. See structural drawings for other requirements.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into square pattern spaced at 15 feet o.c. maximum to pattern as indicated on drawings. If joint pattern not shown, provide drawings for Architect's approval showing joints not exceeding 15 feet in either direction and located to conform

to bay spacing wherever possible (at column centerlines, half bays, third bays). Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Saw joints as soon as Testing Lab has completed taking the slab flatness and levelness readings, and as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Normally 2 hours maximum after final finishing or 150 psi.

C. Isolation Joints in Slab-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section “Joint Sealants,” are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

D. Contraction Joints at Concrete Topping Over Metal Deck: Cut weakened-plane contraction joints, sectioning concrete into square pattern spaced at 15 feet o.c. maximum to pattern as indicated on drawings. If joint pattern not shown, provide drawings for Architect’s approval showing joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays). Construct contraction joints for a maximum depth of 1/4-inch as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Saw joints as soon as Testing Lab has completed taking the slab elevation readings, and as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Normally 2 hours maximum after final finishing or 150 psi.

3.9 CONCRETE TOPPING SLABS

A. Topping Slabs on Metal Deck:

1. Broom and vacuum clean. Remove all bond inhibiting materials, including plastic ferrules where shear studs occur.
2. Install reinforcing steel and other cast-in items. Electrical conduits shall not be embedded in topping slabs without prior approval from Structural Engineer.

3.10 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in all construction joints at the elevator pit and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.11 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, “Guide for Measuring, Mixing, Transporting, and Placing Concrete,” and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

H. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

I. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

J. Maintain reinforcing in proper position on chairs during concrete placement.

K. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

L. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

O. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

P. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.

Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

R. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

S. Use water-reducing retarding admixture when required by high temperatures, low humidity or other adverse placing conditions, as acceptable to Architect.

3.12 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.13 MONOLITHIC SLAB FINISHES

A. Float Finish: After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. When surface water has disappeared or when concrete has stiffened sufficiently to permit power-driven floats, begin floating operation with power-driven floats using float blades or float shoes only, or by hand-floating if area is small or inaccessible to power units. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Uniformly slope surfaces to drains.

1. Apply float finish to surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing membrane or elastic roofing; and where indicated.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks, and are uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Typical Slab: Apply the minimum of a double trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

a. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch for typical slabs and 1/8 inch for Multi-Purpose/Gym slabs.

2. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic tile is to be installed by thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

a. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

C. Ground and Polished Floor Slabs: Apply the minimum of a triple trowel finish to surfaces scheduled for ground and polished finish.

D. Finish to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

1. Typical Concrete Slabs Unless Otherwise Noted:

a. Specified overall values of flatness and levelness:

1) F(F) 35; and F(L) 25;

b. Specified minimum local values of flatness and levelness:

1) F(F) 24; and F(L) 17.

2. Ground and Polished Concrete Slabs Left Exposed to View as Finish Concrete Surfaces and Concrete Slab Below Wood Athletic Floor:

a. Specified overall values of flatness and levelness:

1) F(F) 45; and F(L) 35;

b. Specified minimum local values of flatness and levelness:

1) F(F) 30; and F(L) 24.

3. Finish: In order to achieve the desired final appearance of the ground and polished concrete, it is critical that the slabs meet or exceed the listed flatness and levelness tolerances. In the event that they do not, it will be the responsibility of the General Contractor to take whatever actions necessary to meet these tolerances. This shall be done at no additional costs to the Owner.

3.14 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.15 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply

according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

1. Apply an evaporation-control compound to all slabs to be exposed in their final condition.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days.

C. It is the contractor's responsibility to ensure that curing procedures avoid slab curl. The Contractor shall use all means necessary to avoid slab curling beyond slab levelness tolerances specified elsewhere herein. Such means include but are not limited to (1) use of an anti-curl mix, (2) avoidance of high-early strength concrete, (3) use of maximum practical aggregate size, (4) avoidance of high range water reducers, (5) protect top surface from too-cold or too-warm temperatures.

D. Curing Methods: Moisture Curing Concrete Slabs:

1. Moisture cure for 7 days using a waterproof sheet curing paper, blanket, or sheeting methods (see ACI 302.1R and ACI 308) prevents evaporation and maintains equalized moisture content through slab thickness.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

F. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

G. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

H. Concrete slabs that are to receive adhesive secured floor coverings shall be based on mix designs, employ placement scheduling, follow placement procedures and be cured in a manner to achieve moisture content levels consistent with floor covering manufacturer's requirements for installation. If moisture levels in the slab exceed those recommended by resilient flooring manufacturer at the time scheduled for flooring installation, adjust schedule to preserve Contract Substantial Completion date and take steps necessary to allow installation of flooring including, but not limited, to dehumidification of spaces, sealers and toppings acceptable to flooring manufacturer and Architect or other measures as required to meet flooring manufacturer's recommendation for flooring installation.

3.16 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install weak concrete mortar joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints that will be covered by resilient flooring or ceramic tile. Overfill joint and strike joint filler flush with top of joint prior to fully setting up. Substitute an epoxy or polyurea based joint filler where exposed sealed concrete slabs are specified trimming after hardening.

3.17 SEALER

A. Apply sealer where indicated. Application shall be in strict accordance with manufacturer's instructions after moisture content has stabilized within sealer manufacturers limits for application. Apply no sealer to areas not indicated to be sealed concrete at completion of construction. Do not use sealer as a curing compound.

3.18 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

C. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

F. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

G. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

H. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

I. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

J. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

K. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.19 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

D. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each days' pour of each type of air-entrained concrete.

F. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

G. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

H. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. ore than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

I. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

J. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

K. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

L. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

M. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and d28-day tests.

N. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

O. Additional Testing: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not

been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other means as directed.

P. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

Q. Concrete Slabs Receiving Carpet or Resilient Flooring Systems:

1. No sealers, curing agents or other fluid applied coatings shall be applied to concrete slabs that are to be covered by carpet or resilient flooring.

2. Perform testing by special inspector to verify concrete substrate moisture emissions, relative humidity moisture content, and pH. Verify results as in conformance to flooring warranty provisions of finish flooring manufacturers.-

a. See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete moisture testing.

3. Concrete Slab Moisture Criteria: Verify all values meet finish flooring manufacturers flooring warranty provisions.

a. Relative Humidity: Maximum 85% unless noted otherwise by warranty provisions of finish flooring manufacturer.

4. Percent Relative Humidity within Concrete Floor Slabs: Test to ASTM F2170.

a. See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete moisture testing. Verify results in conformance to flooring warranty provisions of finish flooring manufacturers.
b. Alkalinity of Concrete Substrate: Test to ASTM F710. - See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete alkalinity testing. Verify results in conformance to flooring warranty provisions of finish flooring manufacturers.

5. Take all necessary measures to adjust concrete slab moisture and alkalinity to levels acceptable according to the installation recommendations and warranty provisions of finish flooring manufacturer. All such measures shall be at no additional cost to the Owner.

3.20 PROTECTION OF CONCRETE FLOORS TO BE LEFT EXPOSED

A. Provide Poly-Craft Mask by PRO TECT® or similar product with equal performance.

B. Install per manufacturer’s instructions. Tape the seams.

C. Diaper all hydraulic powered equipment.

D. Do not cut any ductwork, piping, electrical conduit, or studs on the slab.

E. Any rubber-tired vehicles shall have tires manufactured from non-scuff white rubber.

F. Inform all trades that slab is to be protected at all times.

G. Do not use acids or acidic detergents on slab.

H. Do not store any materials on slab.

END OF SECTION 033000

dj: August 23, 2017/cpl:

dj: November 21, 2017, QC

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures and finishes for the following:

1. Foundations and footings.
2. Slabs-on-grade.
3. Elevated slab on metal deck.
4. Retaining walls.
5. Access ramps and walkways.
6. Waterstops.

B. Related Sections:

1. Division 01 “Sustainable Requirements.”
2. Division 03 Section “Architectural Concrete Finishing” for finishing of exposed concrete slabs at selected areas.
3. Division 07 Section “Bituminous Dampproofing” for coatings on concrete surfaces below grade.
4. Division 07 Section “Sheet Waterproofing” for bentonite waterproofing at footings and foundation walls adjacent to occupied areas.
5. Division 07 Section “Water Repellents” for sealing typical concrete walls.
6. Division 07 Section “Thermal Insulation.”
7. Division 07 Section “Below-Grade Vapor Retarders”.
8. Division 07 Section “Joint Sealants” for sealing concrete joints.
9. Division 31 Section “Earthwork” for drainage (capillary break) fill under slabs on grade.
10. Division 32 Section "Concrete Paving" for concrete pavement and walks.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Refer to General Structural Notes for requirements.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Shop drawings for reinforcement detailing fabricating, bending and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Show all wall elevations.

D. Laboratory test reports for concrete materials and mix design test.

E. Welding certificates. Welders shall be WABO or AWS certified.

F. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Provide mix submittal highlighting the extent of fly ash replacement, including dollar value.

B. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

C. Cut sheets or other documentation for each product/material highlighting recycled content information.

D. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
4. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. Concrete Testing Service: Comply with provisions of Division 01 Section "Quality Requirements" and Division 01 Section "Testing and Inspection Services".

C. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

D. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor’s superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORMING SYSTEM

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on drawings.

1. Use plywood complying with U.S. Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Form for Unexposed Finish Concrete: Plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 mg/l volatile organic compounds (VOC’s) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCMENT

A. Reinforcing Bars: ASTM A 615, Grade as indicated in “General Structural Notes” on drawings.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

C. Fly Ash: ASTM C 618, Type F. 15-45% of the cement mix.

D. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. and as specified. Provide aggregates from a single source for exposed concrete.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

E. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

F. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

G. Water: ASTM C 94/C 94 M and potable.

H. Concrete Strength: See General Structural Notes for required minimum strengths for structural concrete members. Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency for preparing and reporting proposed mix designs.

I. Mixes shall be proportioned so as not to exceed the maximum slumps indicated.

J. Water-Cementitious Material Ratio: See General Structural Notes.

K. Shrinkage-Reducing Concrete: **Concrete mixes for members exposed upon their final condition** shall be proportioned such that the **slab drying shrinkage shall not exceed 0.03% at 90 days** (laboratory conditions). Submit strength and shrinkage test data and mix design to the architect and structural engineer for review a minimum of two weeks prior to placing any concrete.

1. Water-Cement Ratio: 0.40 maximum
2. Strength: Per General Structural Notes
3. Aggregate: Gradation well proportioned and distributed with largest topsize coarse aggregate of ¾ inch.
4. Fly Ash or Slag: Maximum 15%
5. Testing: Trial mixtures tested for shrinkage reduction prior to construction
6. Admixtures: See approved admixtures in section below.

L. Admixtures:

1. General: Provide concrete admixtures that contain not more than 0.05 percent chloride ions.
2. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

a. Use air-entraining admixture in exterior exposed concrete. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
b. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure: 5 to 7 percent air unless indicated otherwise in Structural Notes.
c. Other concrete not exposed to freezing, thawing or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

3. Water-Reducing Admixture: ASTM C 494, Type A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
4. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
5. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
6. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.
7. Shrinkage-Reducing Admixture: Eclipse Floor 200 (by Grace Concrete Products) or Tetraguard AS20 (by BASF) proportioned in accordance with manurfacturer's specifications to meet required maximum drying shrinkage requirements listed above.

a. Dosage: For bidding purposes only, assume 1.5 gallon of admixture per cubic yard of concrete. Final optimum dosage and mix design shall be determined by the concrete supplier/manufacturer based on testing prior to construction.
b. Admixture volume shall replace equal volume water.
c. Water-reducing admixtures: Use only near neutral setting polycarboxylate-based water-reducing admixtures that are compatible with shrinkage-reducing admixtures listed above.
d. Site-mixing of admixtures not allowed.

2.5 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products or approved:

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.
d. Progress Unlimited, Inc.; Superstop.

2.6 WATER CURING MATERIALS

A. Conform to ACI 308, 2.2 – Water Curing methods. Sheet curing procedures except as otherwise accepted by Architect.

B. Sheet Curing Materials:

1. Kraft Curing Paper: ASTM C 171, Type 1.1.1.2, two sheets of reinforced kraft paper cemented together with bituminous adhesive with one white reflective surface, non-staining, moisture retentive.
2. Polyethylene Curing Film: ASTM C 171 Type 1.1.2.2, 10 mil thick, opaque white on one side.
3. White Burlap-Polyethylene Sheeting: ASM C 171 Type1.1.3, burlap with 10 mil opaque white polyethylene coating.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Interior Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 **or** aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

1. Acceptable Products:

a. Epoxy Sealant: Vexcon, Power Coat Epoxy Flexible Joint Sealant, Web Site http://www.vexcon.com
b. Polyurea Sealant: VersaFlex, SL/75, Web Site http://www.versaFlex.com.
c. Lskfjsldj (Addendum 1)

2. Backer Rod: As instructed by manufacturer.

C. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

E. Bonding Agent: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for general bonding of freshly mixed concrete to hardened concrete in accordance with General Structural Notes.
2. See General Structural Notes for epoxy adhesive to be used for grouting of dowels, anchor rods, etc. where specified.

2.8 PROPORTIONING AND DESIGNING MIXES

A. Design mixes to provide normal weight concrete to comply with requirements indicated in “General Structural Notes” on the drawings.

B. Slump Limits: as indicated in “General Structural Notes.”

C. Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect and Structural Engineer.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

F. Alkalinity: Concrete supplier and installer are responsible for providing a slab that meets the criteria below, including remediation if necessary.

1. Slab shall have measured pH ranging between 9 and 10 or as required by flooring manufacturer, whichever is more stringent.
2. Tests shall be performed as specified in Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing.”

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified in the General Structural Notes.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Not permitted without prior approval from Architect.

C. No water shall be added to concrete mix on site.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

a. Class A, 1/8 inch for smooth-formed finished surfaces.
b. Class B, 1/4 inch for rough-formed finished surfaces.

C. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

E. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Forms for Slabs: Set edge forms, bulkheads and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.3 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer’s instructions.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.5 REMOVING FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

B. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.6 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.7 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

D. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

E. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
2. Place construction joints perpendicular to main reinforcement. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Structural Engineer. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements. Provide additional reinforcement at construction joints per Structural Drawings.
3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. See structural drawings for other requirements.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into square pattern spaced at 15 feet o.c. maximum to pattern as indicated on drawings. If joint pattern not shown, provide drawings for Architect's approval showing joints not exceeding 15 feet in either direction and located to conform

to bay spacing wherever possible (at column centerlines, half bays, third bays). Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Saw joints as soon as Testing Lab has completed taking the slab flatness and levelness readings, and as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Normally 2 hours maximum after final finishing or 150 psi.

C. Isolation Joints in Slab-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section “Joint Sealants,” are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

D. Contraction Joints at Concrete Topping Over Metal Deck: Cut weakened-plane contraction joints, sectioning concrete into square pattern spaced at 15 feet o.c. maximum to pattern as indicated on drawings. If joint pattern not shown, provide drawings for Architect’s approval showing joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays). Construct contraction joints for a maximum depth of 1/4-inch as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Saw joints as soon as Testing Lab has completed taking the slab elevation readings, and as soon as the slab will support the weight of the saw and operator without disturbing the final finish. Normally 2 hours maximum after final finishing or 150 psi.

3.9 CONCRETE TOPPING SLABS

A. Topping Slabs on Metal Deck:

1. Broom and vacuum clean. Remove all bond inhibiting materials, including plastic ferrules where shear studs occur.
2. Install reinforcing steel and other cast-in items. Electrical conduits shall not be embedded in topping slabs without prior approval from Structural Engineer.

3.10 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in all construction joints at the elevator pit and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.11 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, “Guide for Measuring, Mixing, Transporting, and Placing Concrete,” and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

H. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

I. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

J. Maintain reinforcing in proper position on chairs during concrete placement.

K. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

L. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

O. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

P. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor’s option.

Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

R. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

S. Use water-reducing retarding admixture when required by high temperatures, low humidity or other adverse placing conditions, as acceptable to Architect.

3.12 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.13 MONOLITHIC SLAB FINISHES

A. Float Finish: After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. When surface water has disappeared or when concrete has stiffened sufficiently to permit power-driven floats, begin floating operation with power-driven floats using float blades or float shoes only, or by hand-floating if area is small or inaccessible to power units. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Uniformly slope surfaces to drains.

1. Apply float finish to surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing membrane or elastic roofing; and where indicated.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks, and are uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Typical Slab: Apply the minimum of a double trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

a. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch for typical slabs and 1/8 inch for Multi-Purpose/Gym slabs.

2. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic tile is to be installed by thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

a. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

C. Ground and Polished Floor Slabs: Apply the minimum of a triple trowel finish to surfaces scheduled for ground and polished finish.

D. Finish to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

1. Typical Concrete Slabs Unless Otherwise Noted:

a. Specified overall values of flatness and levelness:

1) F(F) 35; and F(L) 25;

b. Specified minimum local values of flatness and levelness:

1) F(F) 24; and F(L) 17.

2. Ground and Polished Concrete Slabs Left Exposed to View as Finish Concrete Surfaces and Concrete Slab Below Wood Athletic Floor:

a. Specified overall values of flatness and levelness:

1) F(F) 45; and F(L) 35;

b. Specified minimum local values of flatness and levelness:

1) F(F) 30; and F(L) 24.

3. Finish: In order to achieve the desired final appearance of the ground and polished concrete, it is critical that the slabs meet or exceed the listed flatness and levelness tolerances. In the event that they do not, it will be the responsibility of the General Contractor to take whatever actions necessary to meet these tolerances. This shall be done at no additional costs to the Owner.

3.14 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.15 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply

according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

1. Apply an evaporation-control compound to all slabs to be exposed in their final condition.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than 7 days.

C. It is the contractor's responsibility to ensure that curing procedures avoid slab curl. The Contractor shall use all means necessary to avoid slab curling beyond slab levelness tolerances specified elsewhere herein. Such means include but are not limited to (1) use of an anti-curl mix, (2) avoidance of high-early strength concrete, (3) use of maximum practical aggregate size, (4) avoidance of high range water reducers, (5) protect top surface from too-cold or too-warm temperatures.

D. Curing Methods: Moisture Curing Concrete Slabs:

1. Moisture cure for 7 days using a waterproof sheet curing paper, blanket, or sheeting methods (see ACI 302.1R and ACI 308) prevents evaporation and maintains equalized moisture content through slab thickness.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

F. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

G. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

H. Concrete slabs that are to receive adhesive secured floor coverings shall be based on mix designs, employ placement scheduling, follow placement procedures and be cured in a manner to achieve moisture content levels consistent with floor covering manufacturer's requirements for installation. If moisture levels in the slab exceed those recommended by resilient flooring manufacturer at the time scheduled for flooring installation, adjust schedule to preserve Contract Substantial Completion date and take steps necessary to allow installation of flooring including, but not limited, to dehumidification of spaces, sealers and toppings acceptable to flooring manufacturer and Architect or other measures as required to meet flooring manufacturer's recommendation for flooring installation.

3.16 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install weak concrete mortar joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints that will be covered by resilient flooring or ceramic tile. Overfill joint and strike joint filler flush with top of joint prior to fully setting up. Substitute an epoxy or polyurea based joint filler where exposed sealed concrete slabs are specified trimming after hardening.

3.17 SEALER

A. Apply sealer where indicated. Application shall be in strict accordance with manufacturer's instructions after moisture content has stabilized within sealer manufacturers limits for application. Apply no sealer to areas not indicated to be sealed concrete at completion of construction. Do not use sealer as a curing compound.

3.18 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

C. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

F. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

G. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

H. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.

I. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

J. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

K. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.

L. Repair methods not specified above may be used, subject to acceptance of Architect.

3.19 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Owner will employ a testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

D. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each days' pour of each type of air-entrained concrete.

F. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

G. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

H. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. ore than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

I. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

J. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

K. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

L. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

M. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and d28-day tests.

N. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

O. Additional Testing: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not

been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other means as directed.

P. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

Q. Concrete Slabs Receiving Carpet or Resilient Flooring Systems:

1. No sealers, curing agents or other fluid applied coatings shall be applied to concrete slabs that are to be covered by carpet or resilient flooring.

2. Perform testing by special inspector to verify concrete substrate moisture emissions, relative humidity moisture content, and pH. Verify results as in conformance to flooring warranty provisions of finish flooring manufacturers.-

a. See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete moisture testing.

3. Concrete Slab Moisture Criteria: Verify all values meet finish flooring manufacturers flooring warranty provisions.

a. Relative Humidity: Maximum 85% unless noted otherwise by warranty provisions of finish flooring manufacturer.

4. Percent Relative Humidity within Concrete Floor Slabs: Test to ASTM F2170.

a. See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete moisture testing. Verify results in conformance to flooring warranty provisions of finish flooring manufacturers.
b. Alkalinity of Concrete Substrate: Test to ASTM F710. - See Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete alkalinity testing. Verify results in conformance to flooring warranty provisions of finish flooring manufacturers.

5. Take all necessary measures to adjust concrete slab moisture and alkalinity to levels acceptable according to the installation recommendations and warranty provisions of finish flooring manufacturer. All such measures shall be at no additional cost to the Owner.

3.20 PROTECTION OF CONCRETE FLOORS TO BE LEFT EXPOSED

A. Provide Poly-Craft Mask by PRO TECT® or similar product with equal performance.

B. Install per manufacturer’s instructions. Tape the seams.

C. Diaper all hydraulic powered equipment.

D. Do not cut any ductwork, piping, electrical conduit, or studs on the slab.

E. Any rubber-tired vehicles shall have tires manufactured from non-scuff white rubber.

F. Inform all trades that slab is to be protected at all times.

G. Do not use acids or acidic detergents on slab.

H. Do not store any materials on slab.

END OF SECTION 033000

dj: August 23, 2017/cpl:

dj: November 21, 2017, QC

SECTION 033543 - ARCHITECTURAL CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes:

1. Grinding and polishing of new concrete floors with silicate sealer and densifier floor finish system.

B. Related Sections:

1. Division 03 Section “Cast-In-Place Concrete” for the complete installation of all concrete floor slabs and including all floor slab protection up to Substantial Completion.

1.3 QUALITY ASSURANCE

A. Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, ~~and is currently certified as Craftsman or Master Craftsman by CPAA~~. *who is familiar with the specified requirements and the methods needed for proper performance of work of this section. (Addendum 3)*
3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
4. *The special concrete finish manufacturer shall certify applicator. (Addendum 3)*

B. Walkway Auditor: Certified by NFSI to test polished floors for static coefficient of friction according to NFSI 101-A.

C. Static Coefficient of Friction: Achieve not less than 0.5 for level floor surfaces as determined by quality control testing according to NFSI 101-A.

D. Field Mock-up for Aesthetic Purposes: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

1. Grind, hone, and polish 12 square foot floor area for each finish approved under sample submittals; include edges and joints.
2. Use same personnel, including supervisors, which will perform work.
3. Install products and materials according to specified requirements.
4. Work shall be representative of those to be expected for work.
5. Finish various components to show maximum variation that will exist in work.
6. Approval is for following aesthetic qualities:

    a. Compliance with approved submittals.
    b. Uniformity of sheen.
    c. Uniformity of color.

7. Obtain Architect's approval before starting work on Project.
8. Protect approved field mock-ups from elements with weather resistant covering.
9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect.
11. *In place mockups that pass aesthetic criteria and remain part of the construction are acceptable. (Addendum 2)*

1.4 PERFORMANCE CRITERIA

A. Polishing Systems shall have the following minimum performance properties:

1. ASTM C-642 Absorption: Reduction of 75% of Control
2. ASTM D-5178 Balance Beam Mar Tester: Greater than 50% harder.
3. ASTM D-4060 Modified Taber Abrasion 600 Rev: 0.37% treated vs. 0.68% untreated.
4. ASTM G-154: 5000 HR QUV: No fade, change or erosion.
5. ASTM D-2369 Solids: 18% Minimum.
6. ASTM D-2047 Coefficient of Friction: Average 0.54
7. Reflectivity: Change in gloss to 30, as measured using a gloss meter in accordance with Horiba IG-320 Gloss Checker
8. ASTM C-1378 Stain resistance: Food, chemical, oil and common stain resistance
9. ASTM E-84 Surface burning of building materials:

    a. Class A Flame Spread Index <25 – Results: 0
    b. Smoked Developed Index < 450 – Results: 0

10. ANSI B-101.1-2009 Non-slip properties: High Traction Rating.

1.5 PREINSTALLATION MEETING

A. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:

    a. Owner.

b. Architect.
c. Contractor, including supervisor.
d. Concrete producer.
e. Concrete finisher, including supervisor.
f. Concrete polisher, including supervisor.
g. Technical representative of liquid applied product manufacturers.
h. Walkway auditor.

2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:

a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review procedures, including, but not limited to:

1) Details of each step of grinding, honing, and polishing operations.
2) Application of liquid applied products.
3) Protecting concrete floor surfaces until polishing work begins.
4) Protecting polished concrete floors after polishing work is completed.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.6 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.

1. Prohibit vehicle parking over concrete surfaces to be polished.
2. Prohibit pipe cutting operations over concrete surfaces to be polished.
3. Prohibit storage of any items over concrete surfaces to be polished for not less than 28 days after concrete placement.
4. Prohibit ferrous metals storage over concrete surfaces to be polished.
5. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
6. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
7. Protect from painting activities over concrete surfaces to be polished.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store material in dry, enclosed area protected from exposure to moisture and temperatures below 50 degrees F.

1. Keep containers closed and upright to prevent leakage.
2. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of lot numbers.

1.8 WARRANTY

A. Provide 20 year manufacturer's material warranty that polished surface will remain water repellant, dustproof, hardened, abrasion resistant and food stain resistant.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers: Architectural Concrete Finish products manufactured and supplied by the following manufacturer subject to compliance with requirements:

1. Basis-of-Design Product: Vexcon Chemicals, Inc., Certi-Shine Clear FSR Polished Systems.

B. Alternate Manufacturers: Use of Architectural Concrete Finish products other than the specified products may be used upon approval of pre-bid substitution request. Approval criteria include, but are not limited to, aesthetic acceptability as determined by the Architect, and whether use of a product other than the basis of design product will result in revisions to other components of the Work.

1. RetroPlate Products, RetroPlate 99 & RetroGuard

C. Installers:

1. Berkshire Concrete Restoration, Ridgefield, WA (360) 910-9209.
2. Concrete Restoration, Seattle, WA (206) 937-0415.
3. ~~Meidling Concrete~~ *Cameron-Reilly Concrete*, Spokane Valley, WA (509) ~~924-7180~~ *466-5555 (Addendum 1).*
4. Others as approved.

D. Materials: Provide all materials from one manufacturer:

1. Strippers, Primers, Hardeners, Densifiers and Seal Coatings: Product of manufacturer recommended for substrate and use indicated.

2.2 LIQUID APPLIED PRODUCTS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.

B. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

2.3 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.4 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.
2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Concrete: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with staining and sealing materials.

1. Power sweep floor area, blow-out comers and column footing and plinths. Use sweeping compound to control airborne dust.
2. Thoroughly clean concrete surfaced, removing all coatings, dirt, oil and laitance with concrete stripper as recommended by the finish materials manufacturer.
3. Wet soak floor for minimum duration recommended by the finish materials manufacturer; scrub with automatic scrubber with minimum head pressure and with detergents as recommended by the finish materials manufacturer.
4. Repair damaged and deteriorated concrete according to manufacturer's written recommendations.

B. Dust Control: Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to protect in-place construction, prevent dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 VAPOR TESTING CONCRETE FLOORS

A. Alkalinity:

1. Test Method: Measure pH according to method indicated in ASTM F 710.
2. Acceptable Results: pH between 8 and 10.

B. Moisture Vapor Transmission Rate:

1. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
2. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

C. Relative Humidity:

1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
2. Acceptable Results: Not more than 75 percent.

3.4 POLISHING CONCRETE FLOORS

A. Sequence of Polishing: Perform polishing before gypsum board is installed. Initial Grinding:

1. Use grinding equipment with metal bonded grinding pads.
2. Begin grinding in one direction using sufficient size grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit.

4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Vacuum floor using squeegee vacuum attachment after each pass.
6. Continue grinding until aggregate exposure matches approved field mock-ups.

B. Treating Surface Imperfections:

1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

C. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturer's instructions. [It is preferred to use less caustic colloidal silica-based densifiers as they are safer for workers and less burdensome on the environment.]

D. Grout Grinding:

1. Use grinding equipment and appropriate grit grinding pads.
2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches.
3. Vacuum floor using squeegee vacuum attachment after each pass.

E. Honing:

1. Use grinding equipment with resin bonded grinding pads.
2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads.
3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

F. Polishing:

1. Use polishing equipment with resin bonded polishing and burnishing pads.
2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

G. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer’s instructions.

H. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up.

I. Final Polished Concrete Floor Finish:

1. Aggregate Exposure: Class B
2. Finished Gloss Level: Level 2, Low-Sheen Satin Gloss Appearance

a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
b. Gloss Measurement: Determine the specular gloss by incorporating the following:

1) Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.
2) Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

3.5 CLEANING

A. Remove grinding dust from installation and adjacent areas.

B. Wash polished and stained architectural concrete finish surfaces with cleaner as recommended; rinse surfaces with water and allow to dry thoroughly.

C. Protect completed work from damage.

END OF SECTION 033543

SECTION 042000 – UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Building (common) brick.
2. Mortar.
3. Masonry joint reinforcement.
4. Ties and anchors.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 07 Section “Water Repellants and AntiGraffiti Coatings” for Water Repellent and Antigraffiti Treatment applied to masonry.
2. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
3. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
4. Division 08 Section "Louvers and Vents" for wall louvers and vents installed in exterior masonry assemblies.

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications."
2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Flashing and Trim."
3. Hollow metal frames in unit masonry openings, furnished under Division 08 Section “Hollow Metal Doors and Frames.”
4. Aluminum window systems, furnished under Division 08 Section “Aluminum-Framed Entrances and Storefronts.”

D. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following include building elevations in shop drawings showing locations of the different CMU finishes:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Exposed masonry units.
2. Weep holes/vents.
3. Accessories embedded in masonry.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Joint reinforcement.
5. Anchors, ties, and metal accessories.

F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

G. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

H. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

I. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing as required in accordance with "Testing and Inspection Services" section. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings".

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Building mockup of typical wall area in sizes approximately 60 inches (1500 mm) long by 72 inches (1800 mm) high by full thickness, including accessories.

    a. Provide samples of two architect selected mortar colors in mock up.
    b. Include a sealant-filled joint at least 16 inches (400 mm) long in wall mockup.
    c. Include lower corner of window opening at upper corner of wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    d. Include wall flashing installed for a 24 inch (600 mm) length in corner of wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12 inch (300 mm) length of flashing left exposed to view (omit masonry above half of flashing).
    e. Include metal studs, sheathing, veneer anchors, flashing, and weep holes in masonry wall mockup.

2. *In place mockups that remain part of the construction are acceptable. (Addendum 2)*

1.6 DELIVERY, STORAGE, AND HANDLING

L. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

M. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

N. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

O. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

P. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

Q. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

R. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed, painted or sealed. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

S. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

T. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Quality Standard Product: Ironstone L-4, 2-14 inch Norman, *texture Matte (Addendum 1)*
2. Manufacturer: Interstate Brick Company, 9780 S 5200 W, West Jordan, UT 84081
3. Grade: SW
4. Type: FBX or better
5. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 9,000 psi.
6. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
7. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
8. Size (Actual Dimensions): 3-5/8 inch wide x 2-1/4 inch high x 11-5/8 inch long.
9. Application: Use where brick is exposed unless otherwise indicated.
10. Other acceptable Manufacturer & Product: *Pacific Clay, Brown Flashed Velour (Addendum 1)*

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: Not permitted.

D. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Colored Mortar: Brick unit manufacturer to provide pre-mixed colored mortar as selected by the Architect.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

H. Water: Potable.

2.4 VENEER TIES AND ANCHORS

A. Materials: Use the following materials for all veneer ties, anchors, and continuous joint reinforcing.

1. Stainless-Steel Wire: ASTM A 580, Type 304.
2. Stainless-Steel Sheet: ASTM A 167, Type 304.

B. Adjustable Masonry-Veneer Seismic Anchors

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment to metal studs, or concrete and masonry back-up walls and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lb load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Anchor Assemblies: Hohmann & Barnard, Inc.; DW-10HS Byna-Lok Seismic Veneer Anchor, 14 gauge.
3. Fasteners: As provided by manufacturer for metal studs, concrete, or masonry backup walls.
4. Neoprene Gaskets: Screw-attached masonry veneer anchor manufacturer's standard closed cell neoprene gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating through screw holes to steel studs behind sheathing.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60, unless otherwise noted.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: See Section 076200 “Sheet Metal Flashing & Trim.”

B. Flexible Thru-Wall Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.0 mm).

a. Provide one of the following or approved:

1) Advanced Building Products Inc.; Strip-N-Flash.
2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
3) Hohmann & Barnard, Inc.; TeXtroflash Flashing.
4) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
5) Polyguard Products Inc.; Polyguard 400.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Expansion-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Honeycomb Plastic Weep/Vent: Medium-density polyethylene, 3/8-inch by 3-3/8 inches by 2-1/2 inches high, color per Architect.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:

a. Basis-of-Design Product: Subject to compliance, provide Mortar Net Solutions; CellVent or compatible product by one of the following:

1) Advanced Building Products Inc.
2) Heckmann Building Products, Inc.
3) Wire-Bond.

2.8 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers or approved:

a. Diedrick Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.9 MORTAR AND GROUT MATERIALS AND MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar.
2. Limit cementitious materials in mortar to portland cement and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. Use Type S mortar throughout.
2. Use Typ. Grey mortar for non-colored block.

D. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

E. Hydrated Lime: ASTM C 207, Type S.

F. Masonry Cement: Not permitted.

G. Colored Mortar: Concrete masonry unit manufacturer to provide pre-mixed colored mortar for the installation of integral colored block.

1. Aggregate for Grout: ASTM C 404

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

E. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on the Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, and remove loose masonry units and mortar.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing or concrete backup walls with adjustable masonry-veneer seismic anchors to comply with the following requirements:

1. Fasten anchors over insulation and through sheathing to wall framing or to concrete and masonry backup walls with metal fasteners provided by the manufacturer.
2. Embed connector sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.0 square feet of wall area. Install additional anchors within 12 inches of openings and at intervals not exceeding 8 inches along vertical edges, adding 2 foot long segments of joint reinforcing for anchors that do not align with typical anchor rows beyond.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form vertical control joints in brick using one of the following methods:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants," but not less than 1/2 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 LINTELS

A. Install hot-dip galvanized steel lintels where indicated. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated

3.8 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes formed from plastic tubing 24 inches o.c.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.

1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

3.10 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

dj: January 2, 2018

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Non-shrink grout.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 01 Section “Testing and Inspection Services” for independent testing agency procedures and administrative requirements.
3. Division 05 Section “Steel Decking” for field installation of shear connectors.
4. Division 05 Section “Metal Fabrications” for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
5. *Division 09 Section “Painting” (Addendum 3)*

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment and anchor bolt drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

C. Welding certificates demonstrating compliance with the requirements of the "Quality Assurance" Article.

D. Qualification Data: For installer and fabricator demonstrating compliance with the requirements of the "Quality Assurance" Article. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Weld filler metal for both shop and field-welds.
6. Shop primers.
7. Nonshrink grout.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of structural steel shall have a minimum of five (5) years experience in structural steel installation, including involvement in not less than three (3) projects of similar, or greater, size and complexity.

B. Fabricator Qualifications: Fabricator of structural steel shall have a minimum of five (5) years experience in structural steel fabrication, including involvement in not less than three (3) projects of similar or greater size and complexity. Fabricator shall have their own fabrications plant that has been operating for a minimum of five (5) years. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant for Conventional Steel Building Structures (SBD), *or pay for required shop fabrication inspections by the Owner's special inspection agency.(Add 4)*

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." In addition, all welders performing shop or field-welding of structural steel members shall be WABO certified, or equivalent, as accepted by the Structural Engineer and Building Official.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Structural Steel Shapes, Plates, Angles, Bars, and Rods: As specified in General Structural Notes.

B. Welding Electrodes: Comply with AWS requirements and General Structural Notes.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex, Grade C, carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers (ASTM F 959, Type 325 compressible washers if direct-tension indicators are used).

1. Finish: Plain, uncoated, unless otherwise noted.

B. Tension-Control, High-Strength Bolts: Shall be approved self load indicating types (Bethlehem Indicator Bolts, LeJeune Tension Control Bolts, etc.) and shall be installed in strict accordance with manufacturer’s instructions. See General Structural Notes for required preparation of faying surfaces at slip-critical connections.

C. Anchor Rods or Anchor Bolts: ASTM F 1554, Grade 36, unless otherwise noted. ASTM F 1554 Grade 55 (weldable) or Grade 105 shall be used where specifically indicated on drawings.

1. Configuration: Hooked, except use straight rods where specified on drawings with double nuts at embedded ends.
2. Nuts: ASTM A 563 hex, Grade A, carbon steel nuts for Grade 36 rods up to 1-1/2 inches in diameter, unless otherwise noted. In accordance with ASTM F 1554 recommendations for other rod sizes and grades, unless otherwise noted.
3. Plate Washers: ASTM A 36/A 36M carbon steel, minimum 5/16 inch thick of size required to completely cover hole in connected plate, unless otherwise noted.
4. Finish: Plain, uncoated, unless otherwise noted.

D. Threaded Rods: ASTM A 307, Grade A, unless otherwise noted.

1. Nuts: ASTM A 563 hex, Grade A, carbon steel.
2. Washers: ASTM F 436 hardened or ASTM A 36/A 36M carbon steel.
3. Finish: Plain, uncoated, unless otherwise noted.

E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

F. Threaded Studs (Denoted as “CPL's” on Drawings): ASTM A 108, type CPL Threaded Studs by Nelson Stud Welding Division, TRW Assemblies and Fasteners Group, or equivalent.

G. Deformed Bar Anchors (Denoted as “D2L's” on Drawings): ASTM A 496, type D2L Deformed Bar Anchors by Nelson Stud Welding Division, TRW Assemblies and Fasteners Group, or equivalent.

H. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

J. Couplers: ASTM A 194 or ASTM A 563, size and grade as required to develop full capacity of connected materials. Couplers shall only be used at locations where specified on drawings or where approved by the Structural Engineer.

2.3 PRIMER

~~A. Primer: Fast-curing, lead and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.~~ *See Painting Section 099100. (Addendum 3)*

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P21035A or SSPC-Paint 20.

2.4 NON-SHRINK GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Minimum compressive strength shall be 6,000 psi.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design or Load and Resistance Factor Design Specification for Structural Steel Buildings."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Holes: Cut, drill, or punch standard holes perpendicular to metal surfaces. Do not thermally cut holes or enlarge holes by burning without prior approval from Structural Engineer.

1. Provide holes required for securing other work to structural steel and for passage of other work through steel framing members as indicated on drawings.
2. Weld threaded nuts to framing and other specialty items indicated to receive other work.
3. At pieces connected by threaded studs (CPL's), install 1/4 inch by 2 inch by 2 inch plate washers with oversized holes (holes shall be greater than diameter of weld flash at base of studs) between connected plies at each stud.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SP 1, “Solvent Cleaning,” SSPC-SP 2, “Hand Tool Cleaning,” or SSPC-SP 3, "Power Tool Cleaning."

F. Shear Connectors, Threaded Studs, and Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of connectors, studs, or anchors. Use automatic end welding according to AWS D1.1 and manufacturer's written instructions to develop full capacities of connectors, studs, or anchors.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where indicated or where connections will be exposed to view.
3. AESS: Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances. Minimize weld show-through on exposed steel surfaces.

a) Grind exposed butt welds flush.
b) Dress exposed welds. Do not grind fillet welds without prior approval from the Structural Engineer.

2.7 SHOP PRIMING

A. ~~Shop prime steel surfaces except the following:~~ *The following surfaces shall NOT be primed: (Addendum 3)*

1. Surfaces embedded in concrete or mortar. ~~Extend priming of partially embedded members to a depth of 2 inches~~. (Addendum 3)
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.
~~6.~~ ~~Surfaces not exposed to view upon project completion do not require primer.~~ *Exposed surfaces at project completion to be primed and painted per Section 099100. (Addendum 3)*

~~B.~~ ~~Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:~~

~~1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."~~

~~C.~~ ~~Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.~~

~~1. Stripe paint corners, crevices, bolts, welds, and sharp edges.~~

2. ~~Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.~~

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize all steel lintels and shelf angles located in exterior walls.
3. Galvanize other members where specified in the drawings.
4. Galvanize steel members exposed to the building exterior that are not scheduled to receive painted finish.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing and inspecting agency to perform shop tests and inspections and prepare test reports in accordance with IBC Chapter 17 and the Statement of Special Inspections in the General Structural Notes.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Structural steel inspections may be waived if approved by the Owner and Building Official for work performed on the premises of a fabricator registered and approved to perform such work without special inspection in accordance with IBC Section 1704.2.2.

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents. At the Owner's option, the cost of additional testing performed to determine compliance of corrected work may be at the Contractor's expense.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

1. Complete as-built verification prior to fabrication to the greatest extent possible to allow minor corrections, where approved by the Architect and Structural Engineer, to be made prior to field installation.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Erection stability procedures shall comply with OSHA Regulation 29 CFR Part 1926 Subpart R – Steel Erection, published January 18, 2001. Miscellaneous plates for guying cable attachments, temporary joist bracing, etc. shall be added as required. Contractor shall evaluate columns and provide adequate base plate shims, guys, or temporary bracing as required per OSHA section 1926.755.
2. Do not remove temporary shoring supporting composite deck construction, if required, until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges." Erect AESS to one-half of standard AISC tolerance limits at canopies and sunshades. Remove exposed piece identification marks on AESS.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required. Do not use wood wedges or wood shims. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.

2. Pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed and base or bearing plates solidly grouted.

C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure.

D. Splice members only where indicated.

E. Do not use thermal cutting during erection unless approved by Architect and Structural Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for types of bolts and joints specified on the Drawings.

1. AESS: Install bolts with heads in matching orientation.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where indicated or where connections will be exposed to view.
4. AESS: Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances. Minimize weld show-through on exposed steel surfaces.

a) Grind exposed butt welds flush.

b) Dress exposed welds. Fill exposed welds to a smooth profile where directed by the Architect. Do not grind fillet welds without prior approval from the Structural Engineer.
c) At exposed connections; where erection bolts are not specified on the Drawings they shall be removed. Fill holes with plug welds and grind smooth.
d) Remove all other field welding erection aids at exposed connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds, high-strength bolted connections, and erection procedures and prepare test reports in accordance with IBC Chapter 17 and the Statement of Special Inspections in the General Structural Notes.

1. Provide testing agency with access to places where structural steel work is being erected to perform tests and inspections.

B. Bolted Connections: Bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: In addition to visual inspection, field-welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents. At the Owner’s option, the cost of additional testing performed to determine compliance of corrected work may be at the Contractor’s expense.

3.6 COATING REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded or damaged surfaces of galvanized items and apply galvanizing repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted members and accessories.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

dj::August 23, 2017/cpl/

SECTION 052100 – STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists and joist substitutes.
2. Long-span steel joists.
3. Joist accessories.

B. Related Sections: The following sections contain requirements that relate to this section.

1. Division 01 Section “Sustainable Requirements.”
2. Division 05 Section “Structural Steel” for field quality-control procedures and tests.
3. Division 05 Section “Metal Fabrications” for miscellaneous steel framing.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. SJI "Specifications:” Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders,” latest edition.

B. Joists: Refers to all items listed above in Article A, unless otherwise noted.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide joists capable of withstanding design loads indicated on the Structural Drawings.

B. Unless otherwise indicated, design joists to withstand design loads with live load deflections no greater than the following:

1. Simple Span Roof Joists: Vertical deflection of 1/360 of the span.
2. Cantilevered Roof Joists or Top Chord Extensions: Vertical deflection of 1/180 of the cantilever length.

C. Camber joists in accordance with SJI “Specifications,” unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated. Include product data for primer at prime painted joists.

B. Shop Drawings: Show layout, designation, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Comprehensive structural calculations of joists signed and sealed by the qualified professional engineer responsible for their preparation shall be submitted to the Architect and Structural Engineer for review prior to joist fabrication.
2. Shop drawings and structural calculations shall also be submitted to the Building Official for review as required.

C. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

D. Qualification Data: For manufacturer.

1.6 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standards of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing joists to comply with performance requirements. Professional Engineer signing and sealing structural calculations shall be registered in the State of Washington.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Unfinished Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

C. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer’s standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 FABRICATION

A. Manufacture steel joists of type indicated according to SJI's "Specifications," with underslung ends and parallel chords, unless otherwise indicated.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Do not drill or cut holes in joist members in the field without written approval from the Structural Engineer and joist manufacturer.

D. K-Joist Top-Chord Extensions: Extend top chords of joists with Type S or Type R top-chord extensions as indicated on Structural Drawings, complying with SJI's "Specifications." Do not substitute one type for the other unless specifically approved by the Architect and Structural Engineer.

E. Long-Span Joist and Joist Girder Top-Chord Extensions: Extend top chords as indicated on Drawings and design for loads indicated.

F. Provide bottom chord extensions where required for erection stability or where required to support architectural items. Coordinate stabilizer plates required at steel columns with structural steel fabricator.

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes or provide shim plates as required if joist or roof slope exceeds 1/4 inch per 12 inches.

H. Shop install or design and provide installation details of all field installed web members needed to support miscellaneous point loads specified on the Structural Drawings which do not occur at joist panel points.

I. Provide bolted bearing seat connections at or near steel columns in accordance with the General Structural Notes and in compliance with OSHA Regulation 29 CFR Part 1926

Subpart R – Steel Erection, published January 18, 2001. Coordinate bolt size and spacing with structural steel fabricator.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability. Coordinate bridging layout with mechanical duct routing and other miscellaneous items prior to joist erection.

B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

C. separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials or joists entirely concealed to view upon completion of the project.

C. Apply one (1) coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Space, adjust, and align joists accurately in location before permanently fastening.
2. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
3. Delay rigidly connecting bottom-chord extensions or kickers to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework where required using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. Bolted connections will be visually inspected.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements. At the Owner’s option, the cost of additional testing performed to determine compliance of corrected work may be at the Contractor’s expense.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

dj: August 24, 2017/cpb:

SECTION 053100 – STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
3. Division 05 Section "Structural Steel" for shop- and field-welded shear connectors.
4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. ICC-ES Research/Evaluation Reports: For steel deck.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.
2. Verco Manufacturing Co.
3. Consolidated Systems, Inc.
4. Epic Metals Corporation

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 or G90 zinc coating as indicated. Minimum yield strength as specified on Structural Drawings.

2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 or G90 zinc coating as indicated; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer’s standard white or gray baked-on, rust-inhibitive primer.
2. Deck Profile and Uncoated Steel Thickness: As indicated.
3. Span Condition: As indicated.
4. Side Laps: As indicated.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 or G90 zinc coating as indicated. Minimum yield strength as specified on Structural Drawings.
2. Deck Profile and Uncoated Steel Thickness: As indicated.
3. Span Condition: As indicated.
4. Side Laps: As indicated.

2.4 PREPRIMED DECKING

A. Provide pre-primed roof or floor decking in all areas exposed to view, except non-public areas such as mechanical or electrical rooms.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners (if used): Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws. Mechanical fasteners shall not be used as a substitution for welded/punched attachments unless specifically approved by the Structural Engineer.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field. Use same thickness material for flat sump plates, if used.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring at mid-span of composite floor deck before placing concrete, if required to meet the span limitations specified on the Structural Drawings. Temporary shoring shall remain in place until concrete has reached specified 28-day strength.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks. Adjust the layout of the deck as required to ensure low flutes contact all parallel supports so attachments can be made as specified.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Reinforce openings as specified on the drawings and provide additional closure pieces as required.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Except where indicated otherwise, fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 1/2 inch, effective.
2. Weld Spacing: To all supports, both parallel and perpendicular to the deck flutes, as indicated on Structural Drawings.

B. Side-Lap Fastening: Button punch, mechanically clinch, or weld with 1-1/2-inch long top seam or side seam welds, as indicated on Structural Drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints lapped 2 inches.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck.

1. Install steel angle supporting frame below in accordance with Structural Drawings.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to Drawings and deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 1/2 inch, effective.
2. Weld Spacing: To all supports, both parallel and perpendicular to the deck flutes, as indicated on Structural Drawings. Where field installed headed shear studs occur, each stud is allowed to replace one puddle weld location.

B. Side-Lap Fastening: As indicated on Structural Drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with butted end joints.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck. Cut out closure pieces where they coincide with a headed shear stud placed at a deck low flute to allow concrete to fully surround the stud.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements. At the Owner's option, the cost of additional testing performed to determine compliance of corrected work may be at the Contractor's expense.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas of surfaces exposed to view on prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

dj:August 23, 2017 cpl/

SECTION 054000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing wall framing.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
3. Division 07 Section “Building Insulation” for sound attenuation and thermal insulation installation.
4. Division 09 Section “Gypsum Board Assemblies” for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
5. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Welding certificates.

D. ICC-ES Research/Evaluation Reports indicating that each of the following complies with requirements:

1. Cold-formed metal framing members.
2. Expansion anchors.
3. Power-actuated anchors.
4. Screw fasteners.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing projects similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code–Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing – General Provisions."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 SectionL) "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. California Expanded Metal Products Company.

3. Clark Steel Framing.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Design Shapes in Steel.
6. Dietrich Metal Framing; a Worthington Industries Company.
7. SCAFCO Corporation.
8. Steeler, Inc.
9. The Steel Network
10. United Metal Products, Inc.

B. Manufacturer's must be members of the Steel Stud Manufacturer's Association and products must conform to ICC-ES Report No. 4943.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Type SS, G60 galvanized, of grade as follows:

1. Grade 33 for 18 and 20 gauge sections (0.033 and 0.043 mils).
2. Grade 50 for 16, 14, and 12 gauge sections (0.054, 0.068, and 0.097 mils).

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, G60 galvanized.

2.3 WALL FRAMING

A. Steel Stud Sections: Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.

B. Steel Track: Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated.
2. Flange Width: As indicated.
3. Slotted leg deflection tracks shall be used as indicated.

C. Vertical Deflection Clips: As indicated.

D. Hat-Shaped, Rigid Furring Channel: Minimum metal thickness 0.0396 inches. Depth as indicated.

E. Z-Shaped Furring: Perforated webs as indicated on drawings. Face flange leg minimum 1-1/2 inch unless otherwise indicated, wall attachment flange leg minimum 1-1/2 inch unless otherwise indicated, web depth as indicated. Minimum metal thickness 0.0516 inches.

F. Flat Strap and Backing Plate: Steel sheet for strapping, blocking and bracing in width indicated. Minimum metal thickness 0.0396 inches.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of specified thickness and configuration, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. Stud kickers.
6. Joist hangers and end closures.
7. Hole reinforcing plates.
8. Backer plates.

2.5 ANCHORS AND FASTENERS

A. Steel Shapes: ASTM A 36/A 36M.

B. Anchor Bolts: As specified in Section 03300.

C. Expansion Anchors: As specified in General Structural Notes.

D. Power-Actuated Anchors: As specified in General Structural Notes.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer’s standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

C. Fasten both flanges of studs to bottom track, unless otherwise indicated where clip angles are specified. Space studs as indicated on Drawings.

D. Isolate non-load-bearing steel framing from building structure as indicated to prevent transfer of vertical loads while providing lateral support.

1. Install deep-leg deflection tracks without slotted legs and anchor to building structure where indicated at tops of walls.
2. Where indicated, connect vertical deflection clips to bypassing studs or to infill studs below and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Drawings. Fasten at each stud intersection.

1. Install row of horizontal bridging within 18 inches of single deflection track at tops of walls. Alternately, temporary screws may be installed to attach each stud flange to the deflection track prior to installation of sheathing on each side of the wall. Temporary screws must be removed as sheathing is installed, and sheathing shall not be screwed into the deflection track.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Inspections are required for connections of members of the Seismic Force Resisting System, such as shear wall fastening. See the Quality Assurance Plan in the General Structural Notes for additional requirements.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing will be performed to determine compliance of corrected Work with specified requirements. At the Owner's option, the cost of additional testing performed to determine compliance of corrected work may be at the Contractor's expense.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

dj: August 24, 2017/cpl/

dj: January 2, 2018

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Metal roof ladders.
3. Ships ladders
4. Shelf angles.
5. Loose bearing and leveling plates.
6. Support angles for elevator door sills.
7. Decorative interior metal panels for walls and base, window sills, jambs, and heads.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete.
3. Steel weld plates and angles for casting into concrete not specified in other Sections.

C. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
3. Division 04 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
4. Division 05 Section "Metal Stairs".
5. Division 05 Section "Pipe and Tube Railings".
6. Division 06 Section "Rough Carpentry" for metal framing anchors.
7. Division 07 Section “Preformed Metal Siding” for perforated metal siding screen wall material.
8. Division 07 Section “Roof Accessories” for roof hatches.
9. Division 23 Sections for displacement ventilation grilles.

D. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Delegated-Design Submittal: For ladders including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For professional engineer.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.8 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design ladders.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: As indicated.
2. Material: Steel complying with ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230) coated with rust-inhibitive, baked-on, acrylic enamel.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M). Structural notes on Drawings are very specific.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Paint:

1. Shop Primer for Ferrous Metal: Fast-curing, lead-free, abrasion-resistant, rust-inhibitive primer selected for compatibility with substrates and with types of alkyd-type finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure; complying with performance requirements only of FS TT-P-86, Types I, II and III.
2. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that

maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions and accordion doors from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on accordion door Shop Drawings.

D. Provide supports for overhead doors, and other suspended items as recommended by the item manufacturer. Sizes, types, and attachment of supports to structure above to conform with structural drawings and specifications.

E. Galvanize miscellaneous framing and supports where indicated.

F. Prime miscellaneous framing and supports with specified primer where indicated.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

2.9 METAL ROOF LADDERS

A. Fabricate ladders for the locations indicated, with dimensions, spacings, details an anchorages as indicated. Comply with the requirements of WISHA and ANSI A14.3 or Washington State Labor and Industry Standards, whichever is the most stringent. Unless otherwise indicated in drawings and details fabricate ladders as outlined below:

1. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
2. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
4. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 3/4 inch in least dimension.
5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.

B. Quality Standard Manufacturer: ALACO Ladder Company, 888-310-7040, www.alcoladder.com.

1. Quality Standard Product: ALACO model 564-PRPC

C. Alternate Acceptable Manufacturers: Equivalent products from the following manufacturers may be provided:

1. FS Industries, 800-421-0314, www.fsindustries.com
2. Precision Ladders, LLC, 800-225-7814, www.precisionladders.com

2.10 METAL SHIPS LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
2. Fabricate ships' ladders, including railings from aluminum.
3. Fabricate treads from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch in least dimension.
4. Comply with applicable railing requirements in Division 05 Section "Pipe and Tube Railings."

B. Quality Standard Manufacturer: ALACO Ladder Company, 888-310-7040, www.alcoladder.com.

1. Quality Standard Product: ALACO model H1000-60

C. Alternate Acceptable Manufacturers: Equivalent products from the following manufacturers may be provided:

1. FS Industries, 800-421-0314, www.fsindustries.com
2. Precision Ladders, LLC, 800-225-7814, www.precisionladders.com

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.12 SHELF ANGLES

A. Galvanize shelf angles located in exterior walls.

2.13 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.14 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.15 SUPPORT ANGLE FOR ELEVATOR DOOR SILLS

A. Fabricate from steel material of size as required.

2.16 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.17 DECORATIVE INTERIOR METAL PANELS

A. Material: 3/32” hot rolled steel plate.

B. Finish: Clear wax finish by Sculpt Nouveau.

C. Fabrication: Mount wall panels to plywood backing. Pre-drill for screws per pattern indicated on drawings.

D. Source: Pivot Fabrication, 6501 East Marginal Way, Suyite C, Seattle, Washington. Phone 206-762-3755. Email Ty Swanson ty@pivotmetal.com.

2.18 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.19 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING DECORATIVE METAL PANELS

A. General: Install prefabricated metal panels per fabricator’s written instructions and requirements indicated on Shop Drawings.

1. Install so edges abut cleanly with no exposure of plywood backing.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preassembled steel stairs with concrete filled pan treads and landings.
2. Preassembled steel stairs with metal plate treads, risers, landings and guardrails.

B. Related Sections include the following:

1. Division 05 Section “Metal Fabrications” for steel flat bar stock and steel plate for guardrails.
2. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.
3. Division 07 Section “Formed *Metal (Addendum 1)* Wall Panels” for perforated metal panel guardrails attached to metal stairs.
4. Division 09 Section “Painting” for surface preparation and coatings.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Shop Drawings: Refer to the General Structural Notes and the structural drawings. Show fabrication and installation details for metal stairs including precast concrete components. Include plans, elevations, sections and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Sample: Provide full scale sample of complete metal plate tread, riser, and stringer assembly showing material, texture, shop coating and fabrication.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to the International Building Code. See General Structural notes for criteria.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for metal stairs specified in this Section to be fabricated and installed by the same firm.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.

C. Design Intent: Work shall conform to applicable provisions of NFPA 101 and ADA requirements. Assembly shall provide concrete filled treads and landings.

D. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code--Steel,” and AWS D1.3, “Structural Welding Code--Sheet Steel.”

1.7 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts,

and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Preassembled Stairs:

1. Al's Welding and Steel Fabrication, Inc.
2. Alfab, Inc.
3. American Metal Works, Inc.
4. American Stair Corp., Inc.
5. Sharon Stairs.
6. Pacific Stair Corporation.

2.2 FERROUS METALS

A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Uncoated, Cold-Rolled Steel Sheet: Commercial quality, complying with ASTM A 366/A 366M; or structural quality, complying with ASTM A 611, Grade A, unless another grade is required by design loads.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 FASTENERS

A. General: Provide fasteners sufficient to secure work and carry all applicable loads.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems

indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, handrails, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

B. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

C. Join components by welding, unless otherwise indicated.

D. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

E. Commercial class, unless otherwise indicated.

F. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.

G. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

H. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
6. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
7. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

A. Stair Framing: Fabricate stringers of structural-steel channels, tubes, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers.

Construct platforms of structural-steel tube steel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.

B. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.7 ABRASIVE NOSINGS AT CONCRETE FILLED PAN TREADS

A. Extruded Units: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.

2. Quality Standard Product: Aamstep model 210A.

B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

C. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.8 METAL PLATE TREADS AND LANDINGS

A. Fabricate metal plate treads and landings from 11 gauge ASTM A36 carbon steel with non-skid texture with a 0.025 inch deposit height, minimum 1,000 deposits per square foot. Treads to have integral nosing with 90 degree bend.

1. Quality Standard Product: ALGRIP slip-resistant metal stair treads and nosings.

2.9 FINISHES

A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:

1. Exteriors and Interiors: SSPC SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

E. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. Painting: Apply paint coatings specified for ferrous metal.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PAÿ1 for touching up shop-painted surfaces.

B. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section “Painting.”

END OF SECTION 055100

SECTION 055213 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel pipe and tube railings.

B. Related Sections include the following:

1. Division 05 Section "Metal Stairs" for metal stairs.
2. Division 05 Section “Metal Fabrications” for steel flat bar stock and steel plate for guardrails.
3. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
4. Division 09 Section “Painting” for painting of railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.2 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

2.3 FASTENERS

A. General: Provide the following:

1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
2. Stainless Steel Railings: Provide stainless steel Type 304 hardware and fasteners where painted finish is not indicated on the Drawings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place or post installed anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Where necessary, field weld sections of railings to structural uprights at catwalks.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form changes in direction as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.

I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.7 STEEL AND IRON FINISHES

A. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

E. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

G. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 06100 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 00 and 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fire retardant treated wood blocking and nailers.
2. Fire retardant treated framing with dimensional lumber.
3. Fire retardant treated plywood backing panels.
4. *Reinforced Cement Panels for protection of exterior foundation insulation. (Addendum 3)*

B. Related Sections include the following:

1. Division 01 “Sustainable Requirements.”
2. Division 06 Section "Finish Carpentry" for surface applied wood trim that requires concealed wood blocking for attachment.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NLGA: National Lumber Grades Authority.
2. RIS: Redwood Inspection Service.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Metal framing anchors.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets indicating the bonding agents used for each composite wood and agrifiber product used in the project and demonstrating that no added urea formaldehyde resins are used in these products

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 LEED REQUIREMENTS

A. Composite door, solid core doors, interior plywood, millwork, cabinetry, crown molding, counters, wood panel products used on the interior of the building shall contain no added urea-formaldehyde resins.

B. Adhesives used in field and shop-fabricated assemblies containing these composite wood products shall contain no added urea-formaldehyde resins.

2.3 ADHESIVES, SEALANTS, PAINTS AND COATINGS

A. Refer to VOC limit tables in Division 01 Section “Indoor Air Quality Requirements” for VOC limits for products in this section

2.4 WOOD-PRESERVATIVE-TREATED LUMBER

A. Lumber and Plywood Preservative Treatment by Pressure Process: All above ground lumber and plywood shall be pressure treated using AWPA Use Categories NC2 for interior use, NC3B for exterior use when not in contact with the ground and NC4A for exterior use with ground contact.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in the following AWPA Use Categories:

1. Use Category UCFA: For lumber and plywood used in interior construction where wood material is not in contact with the ground and is protected from exterior weather.
2. Use Category UCFB: Wood and wood based materials in exterior construction that is not in contact with the ground or with foundations, but may be exposed to full effects of weather.

B. Exterior type is suitable for both exterior and interior applications. Interior type is only for interior applications. See Evaluations.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

E. Application: Treat items indicated on Drawings and/or required by building code to be fire retardant treated.

2.6 DIMENSION LUMBER FRAMING

A. Lumber, General: Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by W.C.L.B., for the moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise shown or specified.
2. Provide seasoned lumber with 15% maximum moisture content at time of dressing.

B. All wood blocking, tip plates, etc., shall be pressure treated. Any cuts shall be coated with a brush application of specified preservative.

C. Framing Lumber (2” through 4” thick)” For light framing (less than 6” wide), provide the following grade and species:

1. No. 2 grade, blocking, curbs, and insulation stops
2. Species: Hem-Fir, Fb=1150 p.s.i.

3. Maximum Moisture Content: 19 percent.

2.7 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.9 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.10 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:

1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable authorities having jurisdiction and that evidence of compliance of metal framing anchors for application indicated with building code in effect for Project.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, (Class G185 coating designation.

1. Use for interior locations where stainless steel is not indicated.

2.11 MISCELLANEOUS MATERIALS

A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

2.12 REINFORCED CONCRETE PANELS (Addendum 3)

A. General: Non-combustible, and rot-proof Portland cement panels reinforced with synthetic fibers.

B. Panel Properties: Density of 0.054 per cubic inch.

1. *Impact Resistance: ASTM D 1037 passed.*
2. *Surface Burning Characteristics:ASTM E 84 Flame spread – 0, Smoke developed – 0.*
3. *Water Absorption: ASTM C 1185, less than 30%*

C. Design Standard Product: Finex panels, distributed and fabricated by Foundry Service and Supplies, 909-284-5000, www.foundryservice.com

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, trim, and manufactured wood casework.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use corrosion resistant nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD SLEEPER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PLYWOOD BACKING PANEL INSTALLATION

A. Install fire treated plywood backing panels with stamped fire rating certification in clear view on each individual sheet when installation is completed.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.5 REINFORCED CONCRETE PANELS (Addendum 3)

A. Follow manufacturer's published instructions.

B. Install panels 12 inches below ground level and fasten every 24 inches along the width and height of the panels.

C. Drill holes using a bit with a diameter 1/16 inch larger than the diameter of the screws. Fasteners must penetrate at least ¾ inch into the concrete.

D. Leave a minimum space of 1/8 inch between panels for expansion. If a flexible adhesive sealant is used, leave a minimum space of ¼ inch. Sealing of the joints is not required.

E. Use flashing to cover the screws on the top part of the panels. Use backfill to cover all other screws.

END OF SECTION 06100

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:

1. Plywood wall sheathing.

B. Related Sections include the following:

1. Division 01 “Sustainable Requirements.”
2. Division 06 Section "Rough Carpentry" for wood framing and plywood backing panels.
3. Division 07 Section "Weather Barriers" for water-resistive barrier applied over wall sheathing.
4. Division 07 Section “Thermoplastic Membrane Roofing” for cover board.
5. Division 07 Section “Building Insulation” for composite insulation board.
6. Division 09 Section “Gypsum Board Assemblies” for interior sheathing including gypsum wallboard.
7. Division 09 Section “Ceramic Tile” for tile backer board.
8. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

B. Evaluation Reports: For following products, from ICC-ES:

1. Wood-preservative treated plywood.
2. Fire-retardant-treated plywood
3. Foam-plastic sheathing.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets indicating the bonding agents used for each composite wood and agrifiber product used in the project and demonstrating that no added urea formaldehyde resins are used in these products

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.”.

2.2 LEED REQUIREMENTS

A. Composite door, solid core doors, interior plywood, millwork, cabinetry, crown molding, counters, wood panel products used on the interior of the building shall contain no added urea-formaldehyde resins.

B. Adhesives used in field and shop-fabricated assemblies containing these composite wood products shall contain no added urea-formaldehyde resins.

2.3 ADHESIVES, SEALANTS, PAINTS AND COATINGS

A. Refer to VOC limit tables in Division 01 Section “Indoor Air Quality Requirements” for VOC limits for products in this section

2.4 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 PRESERVATIVE-TREATED PLYWOOD

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/117Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.6 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings.

F. Locations: Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.7 WALL SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exposure 1 sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1 sheathing.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. ICC-ES evaluation report for fastener.

D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION 061600

dj\August 23, 2017 cpl\

dj: January 2, 2018

SECTION 062000 – FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hardwood veneer plywood panels for ceilings and walls.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 “Sustainable Requirements.”
2. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of other Sections.

B. Inspection agencies, and the abbreviations used to reference them, include the following:

1. AWI – Architectural Woodwork Institute
2. HPVA – Hardwood Plywood Veneer Association

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, and dimensions of individual components including profiles, textures, and colors.

B. Samples for Verification:

1. For each finish system and color of panel products with factory-applied finish, provide 3 inch square sample.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets indicating the bonding agents used for each composite wood and agrifiber product used in the project and demonstrating that no added urea formaldehyde resins are used in these products.

1.6 QUALITY ASSURANCE

A. Submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

B. Quality Standard: Comply with AWI AWS for grades of architectural woodwork, construction, finishes, and other requirements. Provide AWI certification labels or AWI certificates of compliance indicating that woodwork meets requirements of grades specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels through the remainder of construction period.

PART 2 - PRODUCTS

2.1 MATERIAL, GENERAL

A. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:

1. Architectural Woodwork Standards (AWS) latest edition: Custom.

B. Hardwood Plywood: HPVA-HP1.

2.2 LEED REQUIREMENTS

A. Composite door, solid core doors, interior plywood, millwork, cabinetry, crown molding, counters, wood panel products used on the interior of the building shall contain no added urea-formaldehyde resins.

B. Adhesives used in field and shop-fabricated assemblies containing these composite wood products shall contain no added urea-formaldehyde resins.

2.3 ADHESIVES, SEALANTS, PAINTS AND COATINGS

A. Refer to VOC limit tables in Division 01 Section “Indoor Air Quality Requirements” for VOC limits for products in this section

2.4 FINISH CARPENTRY

A. Hardwood Veneer Plywood (Wall and Ceiling Panels): Provide Hardwood Veneer pMDI Core Plywood with no added formaldehyde;

B. Quality Standard Product: PureBond process domestic veneer core hardwood plywood as manufactured by Columbia Forest Products, www.cfpwood.com.

1. Core Construction: Polymeric diphenylmethane diisocyanate (pMDI) MDF bonded crossbands.
2. Thickness: 5-ply 12mm.
3. Face Veneer: Grade A White Maple.
4. Back Veneer: Grade 2.
5. Cut: Plain Sliced.
6. Finish: Transparent. AWI Finish System #TR-6 (catalyzed polyurethane). Stain to match Architect’s approved sample.

C. Perforated Hardwood Veneer Plywood (ceiling panel)

1. Same as above with drilled perforations.

a. Pattern: Round
b. Hole Size: 1/4 inch
c. Staggered Centers: 5/8 inch
d. Transparency: 23% open
e. 2” solid edge

D. Perforated Hardwood Veneer Plywood (stair screen panel)

1. Same as above with drilled perforations in custom pattern.
2. Thickness: 7-ply 18mm.

a. Pattern: Round
b. Hole Size: 1/2 inch
c. Staggered Centers: Varies, see plans.
d. Transparency: Varies, see plans.
e. 2” solid edge.
f. Pre-adhesive matching edge band at all exposed edges.

3. Submittal: Provide full-size (full panel) mock-up of perforated panel for review by Architect prior to beginning installation.

2.5 Miscellaneous Materials

A. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, material and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

1. Quality Standard Product for wall panel clips: Monarch aluminum lift off clip model No. MF-375. Monarch Metal Fabrication. www.monarchmetal.com.
2. Quality Standard Product for ceiling panel clips: Star Hanger Systems aluminum ceiling clip. www.starhanger.com.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Condition finish carpentry to average prevailing humidity conditions in installation areas before installation, for a minimum of 48 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
3. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.

3.4 HARDWOOD VENEER PANEL INSTALLATION

A. Install in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

B. Install architectural woodwork to comply with AWI AWS for the same grades specified in Part 2 Products of this Section for type of architectural woodwork involved.

C. Installation Tolerances: Install architectural woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims.

3.5 ADJUSTING

A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 062000

SECTION 064023- ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 00 and 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Stock factory built casework and countertops.
2. Custom fabricated casework and countertops
3. Closet and utility shelving
4. Cabinet hardware and locks
5. Miscellaneous hardware

B. Related Requirements:

1. Division 01 “Sustainable Requirements.”
2. Division 06 Section “Rough Carpentry” for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 PRODUCTS

A. Fabricators to be AWI certified

B. Wood Casework:

1. Materials: Solid wood, plywood, and MDF panels.
2. Finish: Plastic laminate, wood veneers and specialty metals

C. Countertops:

1. Material: Solid Surfacing.

D. Wood Products:

1. Softwood Plywood: DOC PS 1, Medium Density Overlay.
2. Hardwood Plywood and Face Veneers: HPVA HP-1.
3. Particleboard: Straw-based complying with ANSI A208.1, Grade M2
4. Veneer-faced Panel Products: HPVA HP-1, made with adhesive containing no urea formaldehyde.

5. Medium Density Fiberboard (MDF): Provide ANST/AHA A135.4 Hi-impact, smooth single side
6. Trim wood for stain: Premium grade hardwood, oak or maple
7. Trim for opaque finishes: Custom grade hardwood

E. Thermoset Decorative Panels: Particleboard or MDF finished with fused melamine-impregnated decorative paper per LMA SAT-1.

F. High Pressure Decorative Laminate: NEMA LD 3

G. Chemical Resistant High Pressure Laminate: NEMA LD 3, Grade HGP

H. Clear Tempered Float Glass for Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

I. Cabinet Hardware: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

1.4 SUBMITTALS

A. Product Data: For each product specified as work of this section and incorporated into items of architectural woodwork, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material fire-retardant-treated materials cabinet hardware and accessories and finishing materials and processes.

B. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Drawings shall be complete, with full cross-references between drawings. Reproductions of contract documents in any form will not be accepted.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.
3. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge. Show top, front edge and backsplash conditions.
2. Solid-surfacing materials, 6 inches square, including sample seams and backsplash.
3. Stainless steel countertop, 8 by 10 inches, with sample applied to core material. Show top, front edge and backsplash conditions.

E. Exposed cabinet hardware and accessories, one unit for each type and finish. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI ~~Quality Certification Program certificates~~. *Membership. (Addendum 2)*

G. Qualification Data: For Installer and fabricator.

H. Warranty: Sample of special warranty.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets indicating the bonding agents used for each composite wood and agrifiber product used in the project and demonstrating that no added urea formaldehyde resins are used in these products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Installer shall be factory trained installers employed by the manufacturer with experience in successfully installing casework of type indicated for this project, and also employing competent control personnel to conduct effective quality control to ensure compliance with quality installation requirements.

1. List of all completed installations in the last 2 years, including:

a. Project Name and Location.
b. Name of General Contractor and phone number.
c. Name of Owner and phone number.
d. Name of the Architect and phone number.

C. Indoor Air Quality: All particleboard shall comply with the U.S. Department of Housing and Urban Development (HUD) Standard 24 Part 3280 (related to the use of pressed wood products in manufactured homes). Particleboard should also meet this HUD Standard and comply with the National Particle Board Association Voluntary Standard for Formaldehyde Emissions (FPA-987).

D. Source Limitations: Obtain interior architectural woodwork from single source from single manufacturer.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework until painting and similar operations that could damage casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where casework is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping, twisting or sagging of components.

c. Failure of operating hardware.
d. Deterioration of finishes.

2. Warranty Period: Five years from date of Substantial Completion.

1.10 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural casework can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 LEED REQUIREMENTS

A. Composite door, solid core doors, interior plywood, millwork, cabinetry, crown molding, counters, wood panel products used on the interior of the building shall contain no added urea-formaldehyde resins.

B. Adhesives used in field and shop-fabricated assemblies containing these composite wood products shall contain no added urea-formaldehyde resins.

2.2 CASEWORK FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural casework that may be incorporated into the Work include, but are not limited to, the following:

1. ~~Westmark~~ *Frontier Door & Cabinet (Addendum 1)*
2. Custom Source Caseworking (CSW)
~~3.~~ ~~Lemons Millwork~~ *(Addendum 1)*
4. Pacific Cabinets
5. Genothen (Addendum 2)

2.3 ADHESIVES, SEALANTS, PAINTS AND COATINGS

A. Refer to VOC limit tables in Division 01 Section “Indoor Air Quality Requirements” for VOC limits for products in this section

2.4 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of casework and quality grade specified, unless otherwise indicated.

B. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

C. Clear Tempered Float Glass for Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by casework quality standard.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

F. Adhesive for Bonding Plastic Laminate: PVA.

G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.

H. Stainless Steel for Countertops: ASTM A240 316 Grade stainless steel, 18 gauge, No. 4 finish.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware"

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening

D. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.

E. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

F. Manual Latches: Provide manufacturer’s standard manual latches at leaf without lock at all upper and lower cabinets with paired leaves, nickel plated.

G. Adjustable Shelf Standards and Supports: Knape and Vogt #255 recessed shelf standard with Knape & Vogt #256 adjustable shelf clips. Provide four standards for shelves less than 18 inches deep and six standards for shelves 18 inches deep and deeper.

H. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.

4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
5. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.

I. Door Locks: BHMA A156.11, E07121. Provide Olympus Lock 754LC Series using a Sargent No. 11-C480-2 cylinder with keying to match building keying system. Provide spaces and cams as required. Each lock to have metal tumbles and metal strike plate. Locks to have a 26D finish.

J. Drawer Locks: BHMA A156.11, E07041. Provide Olympus Lock 854LC Series using a Sargent No. 11-C480-2 cylinder with keying to match building keying system. Provide spaces and cams as required. Each lock to have metal tumbles and metal strike plate. Locks to have a 26D finish.

K. Grommets for Cable Passage through Countertops: 2-inch OD, brown, molded-plastic grommets and matching plastic caps with slot for wire passage.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for finish indicated.

1. Brushed chrome finish: Satin, brushed steel finish (US 26D and/or US 36D, as applicable).

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.7 FABRICATION, GENERAL

A. Interior Casework Grade: Provide Custom grade interior casework complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate casework to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.

2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets

2.8 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with AWI Section 400 Custom grade for requirements for laminate cabinets.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.

D. Materials for Semi-exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS
2. Edges of Plastic-Laminate Shelves (except where exposed surface): PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
3. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
4. Drawer Sides and Backs: Thermoset decorative panels.
5. Drawer Bottoms: Thermoset decorative panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Core Material:

1. Doors: 11/16" particleboard
2. Drawer:

   a. Fronts: 11/16" particleboard
   b. Sides and back: 5/8" exterior plywood
   c. Bottom: ½" particleboard. Reinforce bottoms over 30" wide.

3. Cabinet ends: ¾" particleboard
4. Cabinet top and bottom: ¾" particleboard
5. Backs: 11/16" particleboard
6. Adjustable and fixed shelves:

   a. Less than 24" long: ¾" particleboard
   b. 24" to 30 long: 1" particleboard
   c. 30" to 48" long: 1" plywood

7. Scribes and fillers: 11/16" particleboard
8. Bases: ¾" exterior plywood

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match Architect's sample.

2.9 PLASTIC-LAMINATE SHELVING

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate shelves.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

D. As scheduled in the drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Plywood.

2.10 PLASTIC-LAMINATE-CLAD-COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for countertops.

B. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of plastic laminate material complying with the following requirements:

1. As scheduled in the drawings.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces.

E. Core Material: As selected by fabricator to comply with quality standard.

F. Core Material at Sinks: Exterior-grade plywood.

G. Core Thickness: 3/4 inch

H. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.11 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for countertops.

B. Solid-Surfacing-Material Thickness: 1/2 inch

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As scheduled in the drawings.

D. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

E. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.12 STAINLESS STEEL COUNTERTOPS

A. Material: ASTM A240 316 Grade stainless steel, 18 gauge, No. 4 finish

B. Methods: All factory welds shall be made using the TIG process. Filler rod shall be of the same composition as the base material.

C. Tops: Form tops with 1.25” high edges with 0.5” return flange. Marine edges shall be integrally formed on all edges. Marine edges shall be 1” wide and 0.25” high. Work surface shall be reinforced with wood core as required. Form edges, flanges and backsplashes integrally from one sheet of steel. Intersections between backsplashes and work surface shall be radiused a minimum of 0.375”.

D. Sink Bowls: Sink bowls shall be made of the same material as the work surface and shall be of equal or greater thickness. Sinks bowls shall be formed from one piece of steel with all inside corners radiused. Welds shall be hammered, ground and polished to

produce a smooth, invisible joint. Sinks shall be welded into the work surface and welds shall be ground and polished to produce a smooth, invisible joint.

E. Joints: Factory welds shall be ground and polished to provide an invisible joint. Field connections shall be mechanical “tongue and groove” interlocking design with concealed bolts to provide a hairline seam.

F. Sound Deadener: Countertops and sinks shall have sound deadening material applied as required to the underside. Nominal thickness shall be 0.062”. Sound deadener shall be waterborne, non-flammable and shall contain no volatile organic compounds.

2.13 SHOP FINISHING

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.

1. Grade: Provide finishes of same grades as items to be finished.

B. General: The entire finish of interior architectural casework is specified in this Section, regardless of whether shop applied or applied after installation. The extent to which the final finish is applied at fabrication shop is Contractor's option, except shop apply at least the prime coat before delivery.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural casework, as applicable to each unit of work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition casework to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural casework, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

C. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Quality Standard: Install casework to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of casework involved.

B. Install casework level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut casework to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

D. Anchor casework to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with casework and matching final finish if transparent finish is indicated.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to walls with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
5. At service counters, undermount bracket to be Lift Assist Damper by Sagutsune

H. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be

joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

I. Provide filler panels at tops of wall-mounted and tall cabinet units to fill gaps between cabinets and walls.

J. Complete the finishing work specified in this Section to extent not completed at shop or before installation of casework. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective casework, where possible, to eliminate functional and visual defects; where not possible to repair, replace casework. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean casework on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures cabinets being without damage or deterioration at time of substantial completion.

END OF SECTION 064023

SECTION 071113 – BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cold-applied, emulsified-asphalt dampproofing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

1. Sonneborn Brand Products.
2. Karnak Corporation.
3. Koppers, Inc.
4. Meadows, W. R., Inc.
5. Deco Products, Inc.; Deco 20 Dampproofing

B. Trowel Coats: ASTM D 1227, Type II, Class 1.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

D. VOC Content: 0.25 lb/gal. (30 g/L) or less.

E. Low-Emitting Materials: Dampproofing used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 PROTECTION COURSE

A. Protection Course, Asphalt-Board Type: ASTM D 6506, premolded, 1/8-inch (3-mm) thick, multi-ply, semi-rigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on one side with polyethylene film.

2.3 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

1. Primer used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

C. Patching Compound: Epoxy or latex-modified repair mortar or manufacturer's fibered mastic of type recommended by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
2. For drying time between coats and drying time prior to back-filling, follow the recommendations of the manufacturer.

B. Apply dampproofing to perimeter footings and foundation walls where opposite side of wall faces building interior or where interior walls face occupied space.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down to bottom of footing.
2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8 inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Apply dampproofing to non-galvanized steel columns, pipe bollards, and other miscellaneous steel items which are partially installed below floor slab level or below grade or where indicated on drawings. Apply to all surfaces below top of slabs and below grade and protect all exposed surfaces from dampproofing material. Where concrete slabs are being poured around vertical steel surfaces, wrap steel with flexable covering to protect dampproofing from concrete material.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Concrete Foundations: Apply 2 brush or spray coats at not less than 2 gal./100 sq. ft. for each coat.

3.5 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed and cured dampproofing. Comply with dampproofing material manufacturers written instructions for attaching protection course.

1. Support protection course with spot application of adhesive of type recommended by protection board manufacturer over cured coating.
2. Install protection board course within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 071113

DJ/January 2, 2018

SECTION 071115 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Extent of sheet waterproofing is to be the full area of all retaining walls that separate earth from interior building area (any location where the grade on one side of the wall is higher than finished floor level on the other side. Extend sheet waterproofing system from top of retaining wall to bottom of footing.

B. Type of sheet waterproofing specified in this section:

1. Rubberized asphalt sheet waterproofing.

a. To be applied to foundation and retaining walls with occupied interior space within them at their level, including but not limited to elevator pit.

1.3 SYSTEM PERFORMANCE

A. Provide sheet waterproofing products which have been produced and installed to establish and maintain watertight continuous seals.

1.4 SUBMITTALS

A. Product Data: Submit product data and general recommendations from waterproofing materials manufacturer, for type of waterproofing required. Include data substantiating that materials comply with requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer: Obtain primary waterproofing materials of each type required from a single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: Firm with not less than three years of successful experience in installation of waterproofing similar to requirements for this project and which is acceptable to manufacturer of primary waterproofing materials.

1.6 JOB CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide sheet waterproofing materials complying with required performance. Other similar materials certified in writing to be equal to or better than specified may be used if acceptable to Architect.

B. Basis of Design Product: The design for the sheet waterproofing is based on "Grace Construction Products," Bituthene 3000 with Dydroduct 220 Drainage Composite. Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

1. Mel-Rol; W.R. Meadows Inc. Check
2. Plastiwrap 60; Progress Unlimited Inc. Check
3. *Carlisle MiraDri 860/861 & MiraDrain 6000/6200 (Addendum 1)*

2.2 PRE-APPLIED WATERPROOFING (Addendum 1)

A. Basis of Design Product: The design for the pre-applied waterproofing is based on Grace Construction Products, "Preprufe 300R Plus". Subject to compliance with requirements, provide the named product or approved comparable product.

2.3 RUBBERIZED ASPHALT SHEET WATERPROOFING

A. Self-adhering membrane of rubberized asphalt integrally bonded to cross laminated polyethylene sheeting, formed into uniform flexible sheets of thickness shown, or not less than 56 mils if no thickness is shown, complying with the following:

1. Tensile Strength (ASTM D 412): 325 psi min.
2. Ultimate Elongation (ASTM D 412): 300% min.
3. Brittleness Temperature (ASTM D 746): -25 deg. F.
4. Hydrostatic Head Resistance: 200 feet min.
5. Water Absorption (ASTM D 570): Not more than 0.10% weight gain after 72 hours of immersion at 70 deg. F.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel: Prefabricated, composite drainage panels, manufactured with a permeable geotextile facing laminated to a molded-plastic-sheet drainage core.

1. Drainage Core: Three-dimensional, non-biodegradable, molded-plastic-sheet material designed to effectively drain water under backfill pressure; complying with the following properties determined according to tests indicated:

a. Compressive Strength: 15,000 psi, minimum; ASTM D 1621

b. Flow Rate: 2.8 gpm per ft., at hydraulic gradient of 0.05 and compressive stress of 25 psi; ASTM D 4716.

2. Geotextile: Woven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation less than 50 percent; complying with the following properties determined according to AASHTO M 288:

a. Survivability: Class 2.
b. Apparent Opening Size: No. 70 sieve, maximum.
c. Permittivity: 0.5 per second, minimum.
d. Film Backing: Polymeric film bonded to drainage core surface.

2.5 INSULATION

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, shiplap edged.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

a. Diversifoam Products
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.

2. Type IV, 25-psi minimum compressive strength.

2.6 AUXILIARY MATERIALS

A. Adhesives: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer, for bonding to substrate (if required), for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashings, adjoining surfaces and projections through membrane.

B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material for flashing as recommended by waterproofing sheet manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Comply with manufacturer's instructions for surface preparation.

B. On vertical foundation walls chip off projections where necessary for proper placement and adhesion of waterproofing sheet.

C. Apply primer to concrete and masonry surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area which will be covered by WP membrane in same working day; re-prime areas not covered by WP membrane within 24 hours.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with combined recommendations of manufacturers and installers involved in work. Schedule installation to minimize period of exposure of sheet waterproofing materials.

C. Extend waterproofing sheet and flashings as shown to provide complete membrane over area indicated to be waterproofed. Seal to projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.

D. Top Edge Seal: For vertical and sloped wall membrane, finish in reglet (where provided), otherwise finish under flashing or under masonry in joint. Caulk exposed edges with mastic or sealant.

E. Expansion Joints: Install joint filler as recommended by manufacturer, with protruding rounded surface. Apply continuous 8" wide strip of membrane on joint followed by membrane application.

3.3 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Place secured and molded-sheet drainage panels to substrate according to manufacturer’s written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends to geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install board insulation before installing drainage panels.

3.4 INSULATION INSTALLATION

A. Install one layer of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch (19mm) of projections and penetrations.

B. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer’s written instructions.

3.5 PERFORMANCE REQUIREMENTS

A. It is required that waterproof membranes be watertight and not deteriorate in excess of limitations published by manufacturer.

3.6 CLEANING

A. After completion, remove any masking materials and stains from exposed surfaces caused by waterproofing installation.

3.7 PROTECTION

A. Institute all required procedures for protection of completed membrane during installation of work over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

END OF SECTION 071115

SECTION 071920 – WATER REPELLANTS AND ANTI-GRAFFITI COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes penetrating water-repellent and anti-graffiti coatings for the following vertical and horizontal surfaces:

1. Exterior and interior, concrete masonry units. (unpainted and unglazed).
2. Exterior and interior exposed concrete walls and footings not scheduled to receive coatings specified in Division 09 Sections.

B. Related Sections:

1. Division 03 Section “Cast-In-Place Concrete” for sealer/hardeners.
2. Division 04 Section “Unit Masonry Assemblies.”
3. Division 07 Section "Joint Sealants".
4. Division 09 Section “Painting” for paints and coatings.

1.3 PERFORMANCE REQUIREMENTS

A. Performance Testing: Provide water repellents that comply with test-performance requirements indicated, as evidenced by reports by a qualified independent testing agency on manufacturer's standard products applied to substrates simulating those on Project using same application methods to be used for Project.

1. Material manufacturer representative to perform preconstruction tests on typical wall surfaces to receive water repellent.

B. Absorption: Minimum 100 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.

1. Brick: ASTM C 67.
2. Precast Concrete: ASTM C 642.
3. Concrete Unit Masonry: ASTM C 140.

C. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.

D. Permeability: Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, per ASTM D 1653.

E. Water Penetration and Leakage through Masonry: Minimum 100 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.

F. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.

B. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

C. Qualification Data: For Installer.

D. Preconstruction Testing Reports: For water-repellent-treated substrates.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.6 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Ambient temperature is above 40 deg F (4.4 deg C).
2. Concrete masonry walls are not treated prior to 30 days after building close-in.
3. Rain or snow is not predicted within 24 hours.
4. Application proceeds more than three days after surfaces have been wet.
5. Substrate is not frozen, or surface temperature is above 40 deg F (4.4 deg C).
6. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency and anti-graffiti protection specified in Part 1 "Performance Requirements" Article within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion. Warranty to be signed by the Manufacturer and the Applicator.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS/ANTI-GRAFFITI

A. Water Repellents.

1. Manufacturers/Products:

a. "Water Repellents" by Professional Products of Kansas.

1) Silicone Rubber with 5%, 8%, or 15 % solids with solvent carrier.
2) VOC compliant.

b. Concrete, "Protectosil" Aqua-Treat 40, Masonry, Protectosil, Chem-Trete PB VOC, by Evonik.

1) 100% active Silane.
2) VOC Compliant.

B. Anti-Graffiti.

1. Manufacturers/Products:

a. Concrete and Masonry, "Sure Klean Weather Seal Blok-Guard and Graffiti Control" Anti-Graffiti, by ProSoCo.

1) Silicone Rubber 8% or 15% solids with solvent carrier
2) VOC Compliant.

b. Concrete, "Protectosil" Anti-Graffiti, by Evonik.

1) 100% active Silane.
2) VOC Compliant.

c. Concrete and Masonry, Anti-Graffiti, by Professional Products of Kansas.

1) Silicone Rubber 8% or 15% solids with solvent carrier
2) VOC Compliant.

2.2 CONCRETE SEALER (SLR in Finish Schedule)

A. Manufacturer/Products:

1. Protectosil "DYNASYLAN BH-N PLUS" by Evonik or approved. 100% active silane treatment with oleophobic additive as represented by Salleeco, Inc. (253) 841-2849.

a. Application: In addition to the specified curing compound, apply water repellent to concrete floor slabs scheduled for sealer coat in Finish

Schedule, a minimum of 28 days after the floors have been poured. Application shall be as recommended by repellent manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to water-repellent manufacturer's written instructions, to ensure that surface is dry enough.

B. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Apply anti-graffiti up from grade level to a minimum height of ten feet above adjacent floor level or as otherwise indicated on the drawings. Include masonry and concrete seat walls and precast concrete trim/caps.

B. Start application at bottom of wall and work up surface with flood coat that has a six-to-eight-inch rundown from the spray pattern.

C. Product shall be applied as supplied by the manufacturer without dilution or alternation, unless noted in the manufacturer’s data sheet.

D. Apply at room temperature and weather conditions recommended by the manufacturer or as written in this specification.

E. Apply with a low pressure (15 psi) airless spray equipment with a fan spray coarse nozzle, flooding the surface to obtain uniform coverage unless otherwise recommended by the manufacturer.

F. Apply at a rate of not less than manufacturer’s recommended square foot/gallon unless the field tests determine that a heavier rate of application is necessary to meet the performance requirements.

G. Apply water repellent by brush only at locations where overspray would affect adjacent materials and where not applicable for spray application.

H. Follow manufacturer's recommendations concerning protection of glass, metal and other non-porous substrates. Contractor will be responsible to clean all surfaces which are contaminated by the water repellent.

I. Follow manufacturer's recommendation concerning protection of plants, grass and other vegetation. Contractor will responsible for replacing all plants, grass or vegetation damaged by the water repellent.

3.3 FIELD QUALITY CONTROL

A. Test Area: Before a sealer application, the following field evaluation will be done. The cost of the field testing will be the responsibility of the Water Repellent Manufacturer.

B. Prepare a three-foot by three-foot area to be sprayed with the water repellent. The area will be determined by the Owner. Apply the water repellent at a rate to achieve a flood coat application. If recommended by the manufacturer, apply a second coat of the water repellent.

C. After allowing five days for the sample to cure, run a RILEM uptake test on the treated area.

1. RILEM Test: Place one tube on the treated and one tube on an untreated area. For masonry substrates place a tube on the brick or block, head joint and bed joint. Owner must be present for application of the water repellent and the test.
2. Acceptable minimum results are as stated in the warranty provisions. Coverage rate used to pass this test section must be used on entire project.

D. Test Area Results: Furnish results of test area absorption on each type of substrate. Test results shall determine application rate.

E. Application: As specified above.

F. Post Application Testing: After 5-day drying period, conduct a total of six (6) RILEM Tests at locations as directed by Architect and submit reports of RILEM Tests completed to Architect.

G. Spray Test: Spray all coated surfaces with water. After surfaces have adequately dried, recoat surfaces that show water absorption.

H. Manufacturer's Field Services: Provide to Architect a written certification that surface preparation methods and final condition have manufacturer's approval and comply with the warranty.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071920

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Perimeter insulation under slabs-on-grade.
2. Foundation wall insulation.
3. Rigid board polystyrene insulation for vertical application.
4. Plywood-polyisocyanurate composite insulation board for exterior wall applications.
5. Concealed building insulation.
6. Void filling loose fill insulation.
7. Sound attenuation insulation.
8. Vapor retarders.

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 07 Section "Thermoplastic Membrane Roofing” for insulation specified as part of roofing construction.
3. Division 07 Section "Through-Penetration Firestop Systems" for insulation installed as part of a fire-resistive penetration system.
4. Division 09 Section "Gypsum Board Assemblies" for installation in metal-framed and wood-framed assemblies of insulation specified by referencing this Section.
5. Division 23 Section "Mechanical Insulation" for insulation installed as part of mechanical systems.
6. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Fiberglass Insulation: Glass in fibrous form, produced in blanket formed into batts (flat-cut lengths) or rolls.

B. Plywood-Poly-isocyanurate Composite Board Insulation: Rigid insulation panel composed of a closed cell polyisocyanurate foam core bonded to a glass facer on one and fire treated plywood on the other to provide continuous insulation in the building envelope.

C. Mineral-Wool/Fiber Insulation: Insulation composed of rock-wool fibers or slag-wool fibers; produced in boards and blankets.

D. Rock Wool Insulation: A non-combustible form of mineral fiber insulation specifically called for in certain fire assemblies.

1.4 SUBMITTALS

A. Product Data: For each type of insulation product indicated.

B. Samples for Verification: Full-thickness units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets or letters from product manufacturers indicating that insulation products installed in the building interior comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.

3. Combustion Characteristics: ASTM E 136.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.

C. Faced Units: Vapor retarder facing to be installed on warm side of exterior walls and ceilings that are a part of the building envelope.

2.2 LEED REQUIREMENTS

A. Insulation shall include 10% minimum recycled content.

B. Insulation products installed in the building interior shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.3 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:

1. Extruded-Polystyrene Board Insulation:

a. Amoco Foam Products Company.

b. DiversiFoam Products.
c. Dow Chemical Co.
d. UC Industries, Inc.; Owens-Corning Co.
e. USG

2. Polyisocyanurate Board Insulation:

a. Atlas Roofing Corporation.
b. Johns Manville International, Inc.
c. RMAX.

3. Polyisocyanurate insulation bonded to Fire Treated Plywood: Closed-cell polyisocyanurate (polyiso) foam insulation layer bonded to a nailing surface.

a. Hunter Panels
b. RMax.
c. Atlas

4. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Knauf Fiber Glass GmbH.
c. Owens-Corning Fiberglas Corporation.
d. Schuller International, Inc.

5. Mineral Wool/Fiber Insulation:

a. Thermafiber.

6. Rock Wool Fire Safing Insulation:

a. Roxul.
b. Thermafiber.
c. Johns Manville (Addendum 3)

2.4 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thickness', widths, and lengths.

B. Extruded-Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C 578 for type and with other requirements indicated below:

1. Rigid Perimeter Foundation Insulation: Styrofoam SM, USG Foamular, or approved equal minimum; K=.24 minimum thermal resistance: R=10. (bead

boards are unacceptable). (Provide at all new foundation walls to 2'-0" below grade.)

2. Rigid Board Wall Insulation: Styrofoam SM, USG Foamular, or approved equal minimum; K=.24 minimum thermal resistance: R=10. (bead boards are unacceptable). (See wall section and detail drawings for applications within exterior walls assemblies.)

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. (See wall section and detail drawings for specific products required, thickness, locations and applications within exterior walls assemblies.)

D. Polyisocyanurate insulation bonded to Fire Treated Plywood: Closed-cell polyisocyanurate (polyiso) foam insulation layer bonded to a nailing surface.

1. Insulation Layer: Rigid Board Polyisocyanurate.
2. Nailing Surface 3/4 inch Fire Retardant Treated CDX Plywood (APA rated).
3. Thermal Performance: R-13 for board with 2 inch foam core.
4. Compliance:

a. ASTM C1289 Type V.
b. ASHRAE 90.1.
c. International Energy Conservation Code (IECC).
d. International Building Code (IBC) Section 2603, Foam Plastic.
e. Tested per NFPA 285 to comply with Section 2603.5.5 of IBC.
f. Density (Nominal) in accordance with ASTM D1622: 2.0 pcf.
g. Compressive Strength in accordance with ASTM D1621: 20 psi.
h. Flame Spread, Core in accordance with ASTM E84: 75 or less.
i. Smoke Developed, Core in accordance with ASTM E84: 450 or less.
j. Water Vapor Transmission in accordance with ASTM E96: Less than 1.5 perms.
k. Water Absorption in accordance with ASTM C209: Less than 0.1 percent by volume.
l. Dimensional Stability in accordance with ASTM D2126: Less than 2 percent linear change.
m. Service temperature: -40 degree F to +250 degree F (-40 degree C to 250 degree C).

5. Quality Standard Product: RMax, 210 Lyon Drive, Fernley, Nevada 89408. Phone: 800-762-9462. www.rmax.com

a. Product: RMax ECOBASEci.

6. Approved Alternative Product: Hunter Panels, 15 Franklin Street, Portland, Maine 04101. Phone: 888-746-1114. www.hunterpanels.com

a. Product: Hunter Panels Xci Ply Class A

7. Approved Alternative Product: Atlas, 2000 Riveredge Parkway, Suite 800, Atlanta, GA 30328. Phone: 770-952-1442. www.atlaswallci.com

a. Product: Atlas EnergyShield PlyPro.

E. Unfaced Fiberglass Insulation: Thermal insulation combining glass fibers with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).

1. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.
2. Thermal Resistance: Minimum R-25 for exterior walls at 8 inch or larger steel studs, and R-11 for interior acoustical, unless thickness or R-value is indicated otherwise on the drawings.

F. Rock Wool Fire Safing Insulation: Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C665 Type 1, that provides fire resistance to ASTM E136 and sound control to ASTM E423.

1. Quality Standard Product: Roxul Inc., 420 Bronte Street South, Suite 105, Milton, Ontario, L9T 0H9, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@roxul.com,

a. Product: Roxul Safe

2. Alternative Approved Product: Thermafiber, Inc., 3711 Mill Street, Wabash, Indiana, 46992, Phone: Toll Free: 1-888-834-2371, email: info@owenscorning.com,

a. Product: Thermafiber Safing

3. Other Approved Product: Johns Manville (Addendum 3)

a. Product: Mineral Wool Safing

4. Fire performance:

a. Non-combustibility: To ASTM E136.
b. Surface Burning Characteristics: To ASTM E84.
c. Flame spread: 0.
d. Smoke developed: 0.

G. Mineral Wool/fiber Insulation: Non-combustible, lightweight, semi-rigid stone wool blanket insulation to ASTM C665 Type 1, that provides fire resistance to ASTM E136 and sound control to ASTM E423. Provide faced insulation with spindle-type fasteners at exterior soffit conditions and where indicated on drawings.

1. Quality Standard Product: Thermafiber, Inc., 3711 Mill Street, Wabash, Indiana, 46992, Phone: Toll Free: 1-888-834-2371, email: info@owenscorning.com,

a. Faced Product: VersaBoard 35 foil faced.
b. Unfaced Product: VersaBoard 35

2. *Other Approved Product: Johns Manville, PO Box 5108 Denver CO 80127, Phone: 1-303-978-2000, email: productsafety@jm.com (Addendum 3)*

a. *Faced and Unfaced Product: Mineral Wool Curtainwall Insulation*

3. Fire performance:

a. Non-combustibility: To ASTM E136.
b. Surface Burning Characteristics: To ASTM E84.
c. Flame spread: 0.
d. Smoke developed: 0.

H. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics. For use where light weight fill of interstitial volume is required.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Central Fiber LLC.
b. GreenFiber.
c. Hamilton Manufacturing Inc.
d. Nu-Wool Co., Inc.

2.5 ACOUSTICAL INSULATION

A. Fiberglass (Use where sound attenuating batts noted on drawings in thickness to fill stud cavity.)

1. R-8 fiberglass batts shall meet the following requirements:

a. Low density unfaced fiberglass.
b. 2-1/2" thick.

2. R-11 fiberglass batts shall meet the following requirements:

a. Low density unfaced fiberglass.
b. 3-1/2" thick.

3. R-19 fiberglass batts shall meet the following requirements:

a. Low density unfaced fiberglass.
b. 5-1/2" thick.

4. Sill Sealer shall meet the following requirements:

a. Low density fiberglass batt.
b. 1” uncompressed thickness.
c. Width of sill sealer shall be the same width as associated runner.

2.6 VAPOR RETARDERS

A. Performance & Design Criteria:

1. 2 mil thick polyamide (Nylon) sheet.
2. Fire Testing: Tested to ASTM E84.

a. Flame Spread Index: 20
b. Smoke Developed Index: 55.

3. Permeance: Tested to ASTM E96

a. 1 perm or less using dry cup method (Procedure A - Desiccant Method).
b. Increases up to 10 perms using wet cup method (Procedure B - Water Method) when moisture increases in building construction, allowing moisture diffusion to interior of building.

4. Quality Standard Product: CertainTeed, “MemBrain” or approved equivalent product by other manufacturer.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

a. Quality Standard Product: Gemco Tuff Bond Hanger Adhesive

2.8 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
2. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
2. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Quality Standard Products:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
c. Gemco; Tuff Bond Hanger Adhesive.

E. Install rigid board insulation on concrete substrate as follows:

1. Fasten insulation to concrete substrates using an insulation manufacturer’s recommended adhesive product in accordance with adhesive manufacturer’s written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation completely separates piping from building exterior.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

E. Install Rock Wool (Fire Rated) insulation in a manner similar to mineral fiber insulation in compliance with the rated design number instructions per the rating agency employed in certifying the fire rated assembly.

3.6 INSTALLATION OF PLYWOOD-POLYISOCYANURATE COMPOSITE INSULATION

A. Install in exterior spaces without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

D. Exposed insulation must be protected from open flame and kept dry at all times.

E. Fasten composite insulation to the structural base wall. Coordinate with the cladding or wall finish manufacturer for the attachment requirements over insulation panels. Contact manufacturer for guidance when determining fastening pattern.

F. Exterior wall insulation is not intended to be left exposed for extended periods of time in excess of 45-60 days without adequate protection. If extended exposure is anticipated all exposed foam surfaces including corners, window and door openings, should be taped with a compatible waterproof tape.

3.7 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.

C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.8 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

dj: January 2, 2018

SECTION 072500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Water Resistive Barrier/ Air Barrier (WRB/AB)
2. Self-Adhered Flashing (SAF)
3. Elasticized Self-Adhered Flashing (ESAF)
4. Self-Adhered Membrane (SAM)
5. Foil Face Self-Adhered Membrane (FFSAM)
6. Sill-Sealer Gaskets

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 01 Section “Envelope Testing” for testing of Weather Barrier components.
3. Division 01 Section “Air Barrier System Quality Control” for administration and coordination of Weather Barrier components and related work.
4. Division 06 Section "Sheathing" for sheathing joint and penetration treatment.
5. Division 07 Section “Building Insulation” for thermal insulation continuous with work of this Section.
6. Division 09 Section “Gypsum Board Assemblies” for insulation installed in conjunction with interior wall finish systems.
7. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. For weather barrier, include data on air penetration resistance and water-vapor permeance based on testing according to referenced standards.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 WARRANTY

A. Provide manufacturer's standard material warranty in which manufacturer agrees to provide replacement material for the fully self-adhered water-resistive vapor permeable air barrier sheets installed in accordance with manufacturer's instructions that fail due to material defects within 20 years of the date of Purchase.

PART 2 - PRODUCTS

2.1 Weather Barrier

A. Weather Barrier Assembly: Collection of weather barrier components assembled together to provide a continuous plane of water and air tightness over the entire building envelope. The system is comprised of, but not limited to, the water resistive barrier/ air barrier, tapes, air barrier sealants, self-adhered flashing, self-adhered membrane, gaskets, joint sealants (specified in Division 7) and roofing (specified in Division 7).

1. Water Resistive Barrier/Air Barrier (WRB/AB): Air-retarder sheeting made from polyolefins; cross-laminated films, woven strands, or spun-bonded fibers; coated or uncoated; without perforations; and complying with ASTM E 1677, Type I.

    a. Mechanically attached w/ manufacturer approved fasteners.
    b. Thickness: Not less than 3 mils.
    c. Permeance: Not less than 20 perm per ASTM E96-00
    d. Flame-Spread Index: 25 or less per ASTM E 84.
    e. Allowable Exposure Time: Not less than three months.
    f. Basis of Design product: Tyvek Commercial Wrap
    g. Other approved product: VaproShield WrapShield SA (Addendum 3)

2. WRB/AB Tape: Pressure-sensitive plastic tape recommended by WRB/AB manufacturer for sealing joints and penetrations.
3. WRB/AB Sealant: Butyl based non-hardening sealant recommended by WRB/AB manufacturer for sealing to all surrounding construction. Apply in concealed locations wherever barrier/wrap is seamed or interrupted by other impermeable construction. Use only outside of vapor retarder.
4. Self-Adhered Flashing (SAF): Self-Adhered flashing width to be 9" or as indicated on drawings to have polyethylene laminate face, butyl adhesive, 30 mil thickness. Acceptable products include Dupont Straight Flash and Henry Blue Skin.
5. Elasticized Self-Adhered Flashing (ESAF): At exterior wall penetrations and as indicated on drawings provide self-adhering flexible flashing tape with elasticized polyethylene laminate, 60 mill thickness, with elastic elongation to exceed 200% or relaxed length. Acceptable products include Dupont Flexwrap-NF.

6. Self-Adhered Membrane (SAM): Self-Adhering sheet product, SBS based,40 mil thick for use in base transitions to concrete, below grade waterproofing and damproofing. Provide Henry Blueskin SALT, Protecto P.W. 100/40, Grace Permabarrier or approved comparable product.
7. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch ; selected from manufacturer's standard widths to suit width of sill members indicated or closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
8. WRB/AB Fastener Caps: Dupont Tyvek Wrap Caps installed per manufacturer's recommendations.
9. Primer: Provide primers as recommended by manufacturers of self-adhered flashing types.

PART 3 - EXECUTION

3.1 WATER RESISTIVE BARRIER/ AIR BARRIER INSTALLATION

A. Cover sheathing with weather barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
3. Seal seams, edges, fasteners, and penetrations with tape.
4. Extend into jambs of openings and seal corners with tape.
5. Comply with manufacturer's written instructions.
6. Provide WRB/AB and its accessories in such a fashion that it provides a continuous air barrier.

3.2 WATER RESISTIVE BARRIER/ AIR BARRIER TAPE APPLICATION

1. Transition, overlap, seal or integrate WRB/AB and its accessories into other weather barrier assembly components in an air tight fashion.

3.3 SELF-ADHERED FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over WRB/AB at all sides of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.
5. Do not allow asphalt bearing flexible flashing to come into contact with PVC roofing. In instances where these two materials are in close proximity, substitute

a non-asphalt bearing self-adhering flexible flashing or add a separation layer as required by manufacturer between self-adhered flashing and PVC roofing.

6. See Drawings for details.

3.4 PROTECTION

A. Protect wall areas covered with primary weather barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.

B. Review condition of weather barrier assembly prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.

C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed primary weather barrier installations.

D. Remove and replace weather barrier assembly affected by chemical spills or surfactants.

END OF SECTION 072500

SECTION 072616 – BELOW-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Underslab vapor retardant sheeting.
2. Taped seams and openings.

B. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete.”
2. Division 20-23 Mechanical Sections.
3. Division 26-28 Electrical Sections.
4. Division 31 Section “Earthwork.”

1.3 SYSTEM DESCRIPTION

A. Vapor retardant sheeting installed over prepared subgrade, capillary break (Specified in Division 31) with concrete slab placed directly over vapor retarder.

B. Taped and sealed penetrations, holes, tears, and vapor retarder laps.

1.4 REFERENCES

A. Reference Standards: Current edition at date of Bid.

B. American Concrete Institute (ACI):

1. ACI 302.IR: Guide for Concrete Floor and Slab Construction.
2. ACI 302.2R: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

C. American Society for Testing and Materials (ASTM).

1. ASTM D 882: Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
2. ASTM D 1004: Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
3. ASTM D 1709: Standard Test Method for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
4. ASTM D1790: Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact.

5. ASTM E 154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover.
6. ASTM E 1643: Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
7. ASTM E 1745: Standard Specifications for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.5 PERFORMANCE REQUIREMENTS

A. Performance Standard: ASTM E 1745, Class A, sheet vapor retarder.

1. Moisture Vapor Permeance: 0.03 perms, 0.30 perms required tested to ASTM E 154.
2. Puncture Resistance: Minimum 2200 grams, tested to ASTM D 1709 Method B.
3. Tensile Strength: 45 foot-pounds per inch, tested to ASTM E 154, Section 9, Method ASTM D 882.

B. Initial Tear Resistance: Minimum 8.0 pounds force in machine direction and transverse direction, tested to ASTM D 1004.

C. Low Temperature Impact Pass minus 120 degrees C, tested to ASTM D1790.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Product Data: Published descriptive literature for vapor retarder and patching materials.

C. Sample: Approximately 8-1/2 by 11 inch, showing compliance with specified requirements. Include accessory products associated with installation.

D. Certified Test Data: Include manufacturer's test data results, certified in writing from independent testing agency.

E. Manufacturer Instructions: Installation instructions, special procedures, and perimeter, penetration and other conditions requiring special attention. Include limitations.

1.7 QUALITY ASSURANCE

A. Geotechnical Report: Report made available to bidders is not a Contract Document. Do not follow Geotechnical Report recommendations that differ from Contract Document provisions.

B. Do not install sand layer or other granular fill over vapor retarder prior to placement of concrete slab-on-grade.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Take precautions to prevent puncturing and tearing vapor retarder.

B. Store in location conforming to manufacturer's instructions.

1.9 COORDINATION

A. Comply with Division 01 Section "Project Coordination" for coordination with work of other Sections.

B. Division 03 Section "Cast-in-Place Concrete" for cast-in-place concrete slab placement directly over vapor retarder.

C. Divisions 22, 23 and 26 for penetrations through vapor retarder by piping, conduits and ductwork.

D. Division 31 for sub-grade under vapor retarder, fully compacted and complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Insulation Solutions, Viper ViperCheck II, Underslab Vapor Retarder, 15-mil Class A.

1. Cell (253) 670-1510, Tel (253) 946-2436, Fax (253) 941-2635, arobertwsimmons@cs.com (R.W. Simmons & Associates, Inc., Bob Simmons, CSI)
2. Email kendall@insulationsolutions.com (Kendall Crooke, CSI, National Sales Mgr)
3. Web Site http://www.insulationsolutions.com

B. STEGO Industries LLC., STEGO Wrap 15-mil Class A.

1. Cell (949) 212-8000, Tel (206) 212-6918, Fax (206) 212-6515, Email trevor@stegoindustries.com Trevor Yost - NW Regional Manager).
2. Tel (877) 464-7834, Fax (949) 257-4113, Email mathewblasdel@stegoindustries.com (Matt Blasdel, Technical Director)
3. Web Site http://www.stegoindustries.com

C. Raven Industries, Vapor Block 15, ASTM E1745 Class A, 15-mil polyolefin vapor retarder. <no local product representation>

1. Tel 1-800-635-3456, Email construction@ravenefd.com / Email allen.schenker@ravenind.com (Allen Schlenker, National Market Specialist)
2. Web Site http://www.vaporblock.com

D. WR Meadows, Sealtight Perminator 15.

1. Cell (503) 333-6023, Email ballen@wrmeadows.com (Byron Allen, Mfrs Rep)
2. Tel (707) 745-6666, Email wrmnca@wrmeadows.com
3. Web Site http://www.wrmeadows.com

E. Integrally Bonded Vapor Barrier: ASTM E 1745, Class A polyolefin sheet.

1. Product: Grace Waterproofing Products, Florprufe 120

F. Substitution Requests: Submit for approval under provisions of Division 01 Section "Product Substitutions and Options."

2.2 PERFORMANCE / DESIGN CRITERIA

A. Vapor Barrier: Exceed provisions ASTM E1745 Class A, 15-mil polyolefin vapor retarder, as specified by this Section.

1. Properties: Conform to test methods specified by ASTM E1745, Section 7 for results as specified by this Section.

a. Moisture Vapor Permeance: Maximum 0.01 perms for conditioned vapor retarder sheet tested to ASTM E154 Sections 8, 11, 12, and 13 or ASTM F1249.
b. Tensile Strength: Minimum 45 foot-pounds per inch, tested to ASTM E154, Section 9, using apparatus described in either Test Method ASTM D828 or ASTM D882.
c. Puncture Resistance: Minimum 2445 grams, tested to ASTM D1709 Test Method B.

2.3 ACCESSORIES

A. Pressure Sensitive Tape: As instructed by manufacturer.

B. Seam Splice Tape Primer: As instructed by manufacturer.

C. Other Accessories: As instructed by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected.

B. Verify subgrade free from conditions that may cause puncture or other damage to vapor retarder.

3.2 PREPARATION

A. Complete substrate work before beginning work of this Section.

1. Granular Base Course: As specified Division 31. Level, tamp or roll as necessary for smooth level surface prior to installation of vapor retarder.
2. Through-Slab Penetrations: Sealed ready for work of this Section.
3. Underslab Utilities: Drain lines and utilities of Divisions 22, 23 and 26.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, ASTM E 1643, and provisions of Contract Documents.

B. Interior Concrete Slabs-On Grade: Provide vapor retarder as specified this Section whether or not shown on Drawings.

C. Install vapor retarder sheet in widest practical width, parallel with direction of concrete pour, with minimum number of joints over compacted base, as specified Division 31.

D. Lap vapor retarder over footings, and turn up to full slab thickness, except as inhibited by reinforcing, water stops, and other impediments. Seal with pressure sensitive tape to make continuous monolithic membrane moisture barrier at footings, columns, and other penetrations and terminations.

E. Overlap joints 6 inches min. at side and end laps and seal with pressure sensitive tape.

F. Promptly patch tears and punctures as they occur.

G. Repair damaged areas by cutting vapor retarder patches. Overlap tears and holes 6 inch beyond damaged area with patches. Seal patch to installed vapor retarder with pressure sensitive tape or as instructed by manufacturer.

H. Seal pipe penetrations and other openings through concrete slab with vapor retarder or factory fabricated boots and pressure sensitive tape. Field fabricate boots and other shapes as necessary to seal vapor retarder against vapor penetration.

I. Place concrete slab-on-grade directly over installed vapor retarder under work of Section 033000. Do not install granular fill layer over vapor retarder.

3.4 FIELD QUALITY CONTROL

A. Inspect competed installation prior to placing concrete slab-on-grade in accordance with Division 01 Section “Quality Requirements.”

B. Verify vapor retarder installed in accordance with manufacturer’s instructions with permanent penetrations taped and sealed.

C. Verify that vapor retarder has not been penetrated by screed stakes and that base set screed posts are in place.

3.5 ADJUSTMENTS

A. Patch penetrations with pressure sensitive tape and make adjustments as necessary to maintain performance of vapor retarder as instructed by manufacturer.

B. Do not patch or seam when vapor retarder is wet.

3.6 PROTECTION

A. Protect From Penetration: Do not permit use of ground set stakes, screed posts, and other items to puncture vapor retarder. Where punctured, remove penetrating item and patch vapor retarder, as specified this Section, before placing concrete.

B. Lay plywood or other protection board over installed vapor retarder at areas of heavy traffic and other construction loads. Do not stack construction materials directly on vapor retarder.

END OF SECTION 072616

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-fastener, lap-seam solid and perforated corrugated zinc wall panels.

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”

2. Division 05 Section “Metal Fabrications” for steel plate wall panels and base.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, installation instructions, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

D. Qualification Data: For Installer.

E. Sample Warranties: For special warranties.

F. Maintenance Data: For metal panels to include in maintenance manuals. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: (1) year from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F ambient.

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed perforated metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

B. Corrugated-Profile, Exposed-Fastener Metal Wall Panels formed with alternating sine-curved ribs across width of panel.

1. Solid zinc alloy sheet complying with ASTM B69-13

a. Nominal Thickness: 0.040 inch (1.02 mm).

2. Rib Spacing: 2.67 inches o.c.
3. Panel Coverage: 35.5 inches (901.7 mm.)
4. Panel Height: 7/8 inch (22.225 mm)
5. Quality Standard Manufacturer: Jarden Zinc, P.O. Box 1890, Greenville, TN 37744-1890. Phone: 423-639-3125. www.jardenzinc.com

a. Alternate Acceptable Manufacturer: VMZinc by Umicor Building Products, 3600 Glenwood Avenue, Suite 250, Raleigh, NC 27612. Phone 919-874-7173. www.vmzinc-uw.com

6. Quality Standard Product: Jarden Zinc Corrugated Sine Wave Panel.

a. Alternate Acceptable Product: VMZinc corrugated sine wave panel.

C. Corrugated-Profile, Exposed-Fastener Perforated Metal Wall Panels.

1. Same as Metal Wall Panels with the following perforation pattern, to be located at the second floor exterior deck and all guardrails:

a. Pattern: Round
b. Hole Size: 0.188 inch
c. Staggered Centers: 0.313 inch
d. Transparency: 33% open

2. Same as Metal Wall Panels with the following perforation pattern, to be located at the roof level mechanical screen:

a. Pattern: Round
b. Hole Size: 0.188 inch
c. Staggered Centers: 0.375 inch
d. Transparency: 23% open

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural

Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Zinc panel Color and Finish: Jarden Zinc Presidential Onyx Black.

1. Alternative acceptable color and finish: VMZinc Anthra-Zinc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Manufacturer’s recommended fasteners for surfaces exposed to the exterior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 075410 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. ~~Mechanically attached~~ *"Fully adhered" (Addendum 2)* single ply thermoplastic membrane roofing system with hot air welded seams.
2. Rigid insulation, tapered rigid insulation, vapor barrier and roof board.
3. Membrane flashings, membrane clad metal flashing (material only), pedestrian traffic membrane, fastenings, and adhesives.
4. Separation board.
5. Cover board.
6. Roof insulation.
7. Underlayment and vapor retarders/temporary roofing.

B. This Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 05 Section "Steel Decking."

C. Related Sections include the following:

1. Division 01 Section "Sustainable Requirements."
2. Division 05 Section "Steel Deck" for furnishing acoustical deck rib insulation.
3. Division 06 Section "Rough Carpentry" for blocking.
4. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
5. Division 07 Section "Roof Accessories"
6. Division 07 Section "Joint Sealants."
7. Division 15 Section "Soil, Waste, Vent and Storm Drain Piping Systems" for roof drains.

D. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 REFERENCES

A. Reference Standards: Current edition at date of Bid, except where indicated.

B. ASTM International (ASTM):

1. ASTM C 518: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

2. ASTM D 1621: Test Method for Compressive Properties of Rigid Cellular Plastics.
3. ASTM D 1622: Test Method for Apparent Density of Rigid Cellular Plastics.
4. ASTM D 2126: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
5. ASTM D 4434: Specification for Poly (Vinyl Chloride) Sheet Roofing.
6. ASTM D 6754: Standard Specification for Ketone Ethylene Ester Based Sheet Roofing.
7. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories, Inc. (UL): UL 790 -Tests for Fire Resistance of Roof Covering Materials.

D. Factory Mutual (FM): Factory Mutual Approval Guide, Loss Prevention Data Sheets.

E. ANSI/SPRI ES-1.

1.4 DEFINITIONS

A. PVC: Poly vinyl chloride.

B. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

C. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.

D. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

D. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing

system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-90.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Dimensioned drawings showing roof outlines, profile details of flashing methods for penetrations and terminations, and technical acceptance from manufacturer.

C. Product Data: Manufacturer's current product literature, installations instructions, and specifications.

D. Samples: Minimum 8 inch by 10 inch sample of membrane, membrane coated metal flashing, fasteners, and system components showing compliance with specifications.

E. Color Samples: Manufacturer’s standard membrane colors.

F. Qualified Installer Certification: Manufacturer=s written statement, signed by manufacturer's authorized representative, certifying roofing installer as trained and certified by manufacturer to perform work for this Project.

G. Product Certification: Manufacturer’s written statement, signed by manufacturer=s executive officer, certifying compliance with provisions of Contract Documents including referenced ASTM, UL, and FM Standards.

H. Manufacturer's Instructions: Include manufacturer's guide specifications, installation requirements, special procedures, and conditions requiring special attention.

I. Sample Warranty: Meet or exceed provisions specified by this Section.

J. Tapered Insulation Layout Plan – provide tapered layout plan for those areas requiring tapered insulation. Layout plan shall include, but not be limited to, crickets, sumps, transitions and indicate slope (units vertical/ units horizontal) of drainage valleys.

1.7 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets for each roofing material that includes information regarding the initial Solar Reflectance Index (SRI), tested in accordance with ASTM 1980 requirements. If SRI

information is not available, information must be provided for both the emissivity and solar reflectance values.

1.8 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Provide system and components under responsibility of single roofing manufacturer.
2. Perform roofing and related flashing and sheet metal work by or under supervision of single installer.

B. Roofing Foreman: On site for full duration of the roofing portions of the Project.

C. Polyisocyanurate Insulation Board: Supply in thickness to produce R-Value as indicated.

1.9 QUALIFICATIONS

A. Installer:

1. Trained and certified by manufacturer as authorized installer for work of this Project.
2. 5 years documented experience installing single ply roofing of comparable scope and type.
3. Roofing Foreman: Minimum 2 projects installing manufacturer's system.

1.10 PRE-INSTALLATION CONFERENCE

A. Arrange, in accordance with Division 01 Section “Project Meetings.”

B. Attendance: Contractor, installer, Owner, Architect, Owner’s Roofing Consultant, manufacturer, and as requested to attend.

C. Arrange conference and job walk-through, minimum 2 weeks prior to completion of roofing substrate and beginning roofing work of this Section.

1.11 REGULATORY REQUIREMENTS

A. Underwriters Laboratories (UL): UL 790, Class A Fire Hazard Classification.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

1. Store rolls lying down on pallets, cover, and protect from moisture.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
2. Store bonding adhesives at temperatures above 40 degrees F.

C. Store flammable materials in cool dry place away from sparks and flame.

D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

E. Do not overload roof. Load goods so as not to cause structural damage or failure, or create a safety hazard.

1.13 PROJECT SITE CONDITIONS

A. Weather Conditions: Conform to manufacturer’s instructions during extremes of temperature and humidity. Where moisture is present, do not install over wet or moist substrates.

B. Install only as much of the roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat-welded before leaving the job site that day.

C. All surfaces to receive new materials shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application. Do not apply roofing to damp or wet substrate.

D. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

E. Uninterrupted waterstops shall be installed at the end of each day’s work and shall be completely removed before proceeding with the next day’s work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

1.14 COORDINATION

A. Coordinate with related work of other Sections in accordance with Division 01 Section “Project Coordination.”

B. Arrange work sequence to prevent foot traffic, rolling loads, movement of equipment, and storage of materials, on unprotected roofing membrane.

C. Coordinate with Division 22 Section "Soil, Waste, Vent and Storm Drain Piping Systems."

1.15 WARRANTY

A. Conform to Warranty provisions specified Division 01 Section "Warranty Procedures."

B. Manufacturer: Standard 20 year non-prorated, labor and materials watertightness System Warranty, including, vapor barrier, roof board, rigid insulation, fasteners, and membrane roofing and flashings as complete roofing system. Warranty exclusions for conditions leading to standing water and insufficient roof slope not accepted.

1. Manufacturer to provide 2 hours of training to Owner's staff in the maintenance and repair of membrane roofing. Warranty to include roof integrity of up to 70 MPH.

C. Contractor: 2 year workmanship warranty guaranteeing watertightness for system including at flashing, terminations, and penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Sarnafil, Inc.

a. Tel 1-800-727-6234 / (253) 274-1500, Fax (253) 274-1501, Cellular (206) 351-9126, Email w@wmclarkandassociates.com (Northwest Regional Office, William Clark CSI, CDT).
b. Web Site http://www.sarnafilus.com.

B. Acceptable Alternative Manufacturers:

1. Carlisle SynTec

a. Tel 1-800-479-6832 / (253) 271-3221, Email Karen.smith@syntec.carlisle.com (Northwest Regional Office, Karen Smith).
b. Web Site http://carlislesyntec.com

2. Duro-Last DTF 60 mil

a. Tel 1-866-735-8824 / (253) 225-4858, Email wmmwilliams@msn.com (Northwest Regional Office, Will Williams).
b. Web Site http://duro-last.com

3. FiberTite 60 mil Fleecebacked Membrane

a. Tel 1-800-927-8578 / (503) 516-6336, Email ian@exteriorallied.com (Northwest Regional Office, Ian Murphay).
b. Web Site http://www.fibertite.com

4. Soprema

a. Tel 1-800-356-0066 / (425) 305-9069, Email kbryant@soprema.us (Northwest Regional Office, Kelly Bryant).
b. Web Site hhtp://www.soprema.us

C. Substitution Requests: Submit for approval prior to Bid under provisions of Division 01 Section "Product Substitutions and Options."

2.2 LEED REQUIREMENTS

A. For roof surfaces with a slope of less than or equal to 2:12, roofing material must have a minimum Solar Reflectance Index (SRI) of 78.

B. For roof surfaces with a slope of greater than 2:12, roofing material must have a minimum Solar Reflectance Index (SRI) of 29.

2.3 ROOFING MATERIALS

A. PVC Membrane: Fiberglass or polyester fabric reinforced polyvinyl chloride (PVC) thermoplastic membrane.

1. Classification: ASTM D 4434 Type II Grade 1 or Type III.
2. Thickness: Minimum 60 mils thick.
3. Color: White
4. ~~Mechanically Attached~~ *Fully Adhered (Addendum 2)* Sarnafil S327.

B. Prefabricated Membrane Flashing: Manufacturer's standard manufactured configurations for flashing pipe penetrations, inside and outside corners, and other conditions. Match color and thickness of roofing membrane.

1. Sarnafil S327.

C. Traffic Membrane (Traffic Mats): Manufacturer's, 2 foot by 2 foot square, non-skid PVC thermoplastic membrane.

2.4 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.

C. Sealants: Membrane manufacturer's approved sealant shall be used to seal penetrating through the membrane system and at miscellaneous sealant applications that come in contact with roof system components.

D. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

E. Sealing Tape Strip: Compressible foam with pressure sensitive tape on one side. Sealing tape strip is to be used with metal flashing as preventive measure against air and wind-blown moisture entry.

F. Metal Reglet: Manufacturer's 6063T5 extruded aluminum counterflashing, approximately 2.25-inches wide and 0.10-inches thick, prepunched at 8-inches o.c. for attachment to the wall or curb. Use prefabricated mitered inside and outside corners where walls intersect.

G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

H. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

I. PVC Clad Metal: Manufacturer's 24 gauge G90 galvanized metal with 20 mil ± unsupported PVC membrane laminated on one side. Color shall match roofing membrane. Provide this material to Division 07 Section "Sheet Metal Flashings and Trim" subcontractor to be fabricated into metal flashings and installed as work of Division 07 Section "Sheet Metal Flashings and Trim".

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

K. Wormgear Clamps: 100% 316 Stainless steel wormgear clamp.

2.5 VAPOR BARRIER / TEMPORARY ROOFING

A. Vapor Barrier/ Temporary Roofing Self-adhering Membrane: Provide Sarnavap – Self Adhered by Sika/Sarnafil. Provide as the vapor retarder where a vapor retarder is identified as part of the roof type.

2.6 GYPSUM COVER BOARD

A. Manufacturers:

1. Georgia Pacific, Dens-Deck, glass mat faced, silicone-treated gypsum core panel.
2. Owens Corning, Strataguard, silicon impregnated, solid reinforced gypsum core panel. Dens-Deck Primed at Cover Board applications.

B. Size and thickness:

1. Cover Board: 1/2-inch, 4 feet by 8 feet.

C. Fire Resistance: As required to meet requirements for barrier board at roofing assembly.

1. Surface Burning Characteristics: Tested to ASTM E 84

a. Flamespread: 0.
b. Smoke Developed: 0.

2. Non-Combustible: Tested to ASTM E 136.

2.7 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Thermal insulating value shall be a minimum of R-41 overall. Product shall be polyisocyanurate board.

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers:

a. Atlas Roofing Corporation.
b. Johns Manville International, Inc.
c. RMAX.

D. Tapered Insulation: Provide factory-tapered polyiso insulation boards fabricated to achieve a final slope of 1/4 inch per 12 inches, unless otherwise indicated. Provide wherever cricketing material does not achieve specified minimum slopes.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Cricketing Material:

1. Tapered Insulation: Provide in 1/8", 1/4", 1/3" standard or custom taper per foot slopes as indicated roof slopes require.
2. Tested: UL Class A for ballasted roof systems and fully adhered roof systems over combustible and non-combustible decks.
3. Secure cricketing to substrate using manufacturer recommended adhesive. Prepare upper surface of cricketing for adhesive attachment of polyiso roof insulation specified herein.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.9 ACCESSORIES

A. Solvent Cleaner: As instructed by manufacturer for removal of adhesive and contaminants from membrane.

B. Hot Air Welder: As instructed by manufacturer for membrane joint seaming.

C. Provide roofing membrane and roofing insulation adhesives compatible with and recommended for the substrate and component being adhered by the roofing membrane or insulation manufacturer.

D. Mastic: As instructed by manufacturer.

E. Roof / Equipment Curbs: Coordinate with Section 077200.

F. Roof Equipment: Coordinate with Division 15.

G. Other Accessories: In accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions as satisfactory to receive work of this Section.

3.2 PREPARATION

A. Work of Other Sections: Verify that metal flashings, crickets, roof penetrations, and other preliminary related work are in place.

B. Roof Decks: Sweep and vacuum surfaces clean prior to roofing application.

1. Surface: Free of protruding fasteners, depressions, fins, raised edges.
2. Condition: Structurally sound, dry, free of contamination.
3. Weather: Moisture, temperature conditions in accordance with roofing manufacturer's instructions.

C. Make provisions for roof penetrations, including vents, roof accessories, and equipment specified Divisions 15.

D. Crickets: Provide for positive drainage and for watertight installation as instructed by manufacturer.

3.3 INSTALLATION

A. Install roofing components in accordance with manufacturer's instructions and provisions of Contract Documents.

3.4 COVER & SEPARATION BOARD INSTALLATION

A. Install as required to meet required UL Fire Hazard Classification for roofing assembly.

B. Adhesively attach over uninsulated steel deck where required to act as thermal barrier board and membrane substrate conforming to UL for Fire Resistance Classification indicated. Apply in multiple layers with joints in successive layers offset.

C. Provide roof curbs, nailers and blocking at appropriate heights and locations prior to installation of insulation.

D. Separation board shall be between metal decking and rigid insulation.

E. Cover board shall be between the rigid insulation and roofing membrane. Provide cover board at walls abutting roof, where detailed and noted as glass-mat gypsum.

3.5 VAPOR BARRIER / TEMPORARY ROOF INSTALLATION

A. Apply self-adhering sheet material with 6”laps directly over metal roof decking or separation board that has been primed with manufacturer’s water based primer. Flash-in at all obstructions and penetrations through temporary roof. Provide 6” wide galvanized metal plate to support the membrane end lap between metal deck flutes ensuring a complete end lap seal.

3.6 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer’s written instructions for installing roof insulation.

C. Install tapered cricketing where required for drainage as first layer of insulation.

D. Install tapered insulation under area of roofing to conform to slopes indicated where cricketing does not achieve required slope.

E. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

H. Cut and fit insulation within 1/4 inch of projections, and penetrations.

I. Adhesively Fastened Insulation: Install each layer of insulation and secure to deck using adhesive specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Install with adhesive according to type of installation indicated on drawings.

1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

~~3.7 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION~~

~~A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.~~

~~1. Install sheet according to ASTM D 5082.~~

~~B. Mechanically fasten sheet securely at terminations and perimeter of roofing. In-Seam Attachment: Secure one edge of the sheet using fastening plates or battens centered within the membrane seam and mechanically fasten sheet to roof deck. Field-weld seam according to "Seam Installation" Article.~~

~~C. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.~~

~~D. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.~~

~~E. Spread sealant bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring.~~

~~F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.~~

~~G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.~~

~~1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.~~
~~2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.~~
~~3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.~~

~~H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.~~

3.7 ADHESIVELY FASTENED ROOFING MEMBRANE INSTALLATION (Addendum 2)

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
1. Install sheet according to ASTM D 5082.

B. Apply adhesive per roof membrane manufacturer's instructions and secure membrane in manner and under the conditions recommended by the roof membrane manufacturer.
C. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
D. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
E. ~~A~~dhesively secure roofing membrane securely at terminations, penetrations, and perimeter of roofing.
F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.8 MEMBRANE FLASHING INSTALLATION

A. Membrane Flashing: Adhere with contact adhesive and hot air welded seams. Tie into manufacturer's termination bars and clad metal flashing systems as necessary to make watertight system.

1. All flashings shall be installed concurrently with the roof membrane as the job progresses.

2. No temporary flashings shall be allowed without the prior written approval of the Architect and Manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.
3. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
4. Apply bonding adhesive per manufacturer's instructions. Adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. Do not apply to seam area of flashing.
5. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the membrane.
6. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
7. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars. Coordinate flashing with counterflashing installation.
8. Terminate and seal top of sheet flashings at penetrations passing through the membrane; anchor at top with a wormgear clamp. Coordinate flashing with umbrella installation.
9. All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level.
10. Protection Layer: Install protection layer over completed membrane in accordance with membrane manufacturer's recommendations in all areas where wood sleepers or pipe supports are to be installed on the roof membrane.

B. Parapets: Adhere up parapet wall and over top of parapet. Cover with sheet metal coping under work of Division 07 Section "Sheet Metal Flashing and Trim".

C. Vent Stacks and Pipe Penetrations: Flash with manufacturer's standard one-piece manufactured thermoplastic membrane flashing.

D. Seal to air barrier assembly where required. Add separation layer between incompatible materials.

E. Traffic Membrane: Hot air weld to membrane roofing with secure, continuous welds.

1. Minimum 24 inch wide at roof areas subject to foot traffic around mechanical equipment on roofing and as indicated on drawings.

3.9 METAL AND MEMBRANE CLAD METAL FLASHINGS

A. Verify metal flashings are installed as recommended by roofing manufacturer, FM Loss Prevention Data Sheets, and as required to make watertight.

B. Make membrane clad metal flashings watertight with seamless heat welded transitions from membrane roofing to metal flashing at all membrane clad metal flashings provided in this section and formed and installed as specified Division 07 Section "Sheet Metal Flashings and Trim".

3.10 ROOFING ACCESSORIES

A. Roof Drains and Overflow Drains: Sumped roof drain with clamping ring. Coordinate with Division 15 for tie into interior storm water lines.

B. Roof / Equipment Curbs: Coordinate with Section 07720.

C. Install traffic pads in locations indicated in the Drawings.

3.11 FIELD QUALITY CONTROL

A. Manufacturers Field Services: Perform inspections by manufacturers authorized technical representative during interim and completion of roofing work of this Section. Note deficiencies and promptly make oral and written report to Contractor and Architect.

B. Owner's Inspection Services: Owner will engage an exterior envelope inspection service to observe and inspect the roofing installation work.

C. The Applicator shall check all welded seams for continuity using a rounded screwdriver.

D. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane.

E. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Architect, Design Builder or Manufacturer's representative.

F. A minimum of one inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day.

G. Correct welds display failure from shearing of the membrane prior to separation of the weld.

H. The Architect or Owner may take seam cut test samples randomly during application. The contractor shall fully cooperate and repair test samples and identified deficiencies promptly.

I. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.12 ADJUSTING AND CLEANING

A. Correct identified defects and irregularities. Make adjustments as required for watertight installation.

B. Replace work damaged prior to completion Project at no additional cost to Owner.

C. Leave installations clean and premises free from residue and debris from work of this Section.

3.13 PROTECTION

A. Make provisions to protect new and existing work to remain.

B. Protect roofing system from traffic, storage of materials, and other potentially damaging conditions. Correct damaged roofing systems.

END OF SECTION 075410

dj/January 2, 2017

SECTION 075556 - PLAZA ROOFING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of plaza roofing systems

1. Insulation
2. Protection course
3. Roof membrane
4. Drainage Course / Air Layer
5. Cover Board
6. All miscellaneous metals as detailed on drawings

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 07 Section “Sheet Metal Flashing and Trim” for flashings and trims.
3. Division 07 Section “Roof Pavers” for concrete roof pavers and pedestals.
4. Division 22 Sections for Roof Drains.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

B. Canadian General Standards Board, CGSB-37.50-M89, Standard for Asphalt, Rubberized, Hot Applied, for Roofing and Waterproofing.

C. Underwriters Laboratories (UL) Class A.

1.4 DEFINITIONS

A. Protected Membrane Roofing System – a roofing system installed with the water-proofing membrane installed directly on the deck and beneath moisture resistant insulation.

1.5 SYSTEM DESCRIPTION

A. Furnish and install a completed membrane roof assembly including surface conditioner, Monolithic Membrane and flashings, protection course, and insulation.

1.6 SUBMITTALS

A. Certification from an approved independent testing laboratory experienced in testing rubberized asphalt material, that the material meets the CGSB-37.50-M89 standard for rubberized asphalt membranes, including applicable ASTM procedures.

B. Certification showing full time quality control of production facilities responsible for the manufacture of the rubberized asphalt and that each batch of material is tested to insure conformance with the manufacturers published physical properties.

C. Certification showing that all components of the green roof assembly are being supplied and warranted by a single-source manufacturer.

D. Evidence that the roof membrane assembly is currently Class A listed with Underwriters Laboratories.

E. Evidence that the extruded polystyrene insulation if used is free from CFC's.

F. The plant manufacturing the rubberized asphalt material shall have IS0 9001-2000 approval as evidenced by a notarized copy of the official certificate.

G. Provide product data on all components of the plaza roof assembly.

1.7 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets for each roofing material that includes information regarding the Solar Reflectance Index (SRI), tested in accordance with ASTM 1980 requirements. If SRI information is not available, information must be provided for both the emissivity and solar reflectance values.

1.8 QUALITY ASSURANCE

A. The Roofing/Waterproofing Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:

1. Certification or license by the membrane manufacturer as a locally based, authorized applicator of the product the installer intends to use, for a minimum of five (5) years.
2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience

submittal shall correspond to specific membrane system proposed for use by applicator.

B. All components of the "Plaza Roofing" system shall be single source from the system manufacturer.

C. The rubberized asphalt membrane product shall contain an inert clay filler and crumb rubber to enable the product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application.

D. Membrane Manufacturer shall have available an in-house technical staff to assist the contractor, when necessary, in application of the products and final inspection of the assembly.

E. Membrane Manufacturer Qualifications: Manufacturer shall demonstrate qualifications to supply materials of this section by certifying the following:

1. Membrane Manufacturer shall show evidence that the specified rubberized asphalt has been manufactured by the same source for fifteen (15) years and successfully installed on a yearly basis for a minimum of fifteen (15) years on projects of similar scope and complexity.
2. Membrane Manufacturer shall not issue warranties for terms longer than they have been manufacturing their hot fluid rubberized asphalt membrane.

F. Pre-Construction Conferences. The manufacturer will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the roofing assembly.

G. Owner Representative Roofing Inspection: The Owner may contract with a separate roofing inspector to review daily installation as quality control per Section 01400. Coordinate work schedule and provide notice, to the Owner, no less than of 24 hours in advance of all roof related work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and U.L. labels.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60°F (15.5°C) and 80°F (26.6°C). If exposed to lower temperatures, restore materials to 60°F (15.5°C) minimum temperature before using.

1.10 PROJECT CONDITIONS

A. Application of the membrane shall not commence nor proceed during inclement weather. All surfaces to receive the membrane shall be free of water, dew, frost, snow and ice.

B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).

C. Preparation and application of membrane shall be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges shall be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

G. Ballasting requirements vary depending on height of roof deck, parapet height, and design wind speed based upon location of building. CONTACT Hydrotech for ballasting recommendations.

H. General Contractor shall assure that adequate protection is provided after installation so other trades do not damage membrane.

1.11 WARRANTY

A. Upon completion of the work, the contractor shall supply the owner with a single-source warranty of U.S. origin direct from the manufacturer.

B. Each warranty varies in scope and terms. Contact Hydrotech for exact warranty terms and conditions to meet the specific project requirements.

1. Total System Warranties; covers components of the plaza roof assembly, including membrane, flashing, and insulation, and pavers. Includes removal and replacement of the pavers when supplied by and installed per Hydrotech's requirements.

a. Duration of Membrane/Flashing: 20-year (watertight condition)
b. Duration of Insulation: 20-year (80% of original thermal value; remain on the deck withstanding wind speeds not to exceed 70 mph)
c. Duration of Pavers: 10-year (will not crack, split or disintegrate due to freeze-thaw)

PART 2 - PRODUCTS

2.1 GENERAL

A. Refer to Article "System Description" in Part 1: All components shall be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity. Provide roofing system from one of the following listed Manufacturer, or other manufacturers submitted and approved via substitution request a minimum of 10 days prior to Bid.

1. Manufacturer: American Hydrotech, Inc., 303 East Ohio Street, Chicago, Illinois 60611-3318, 800-877-6125 or 312-337-4998. FAX: 312-661-0731. Web Site: http://www.hydrotechusa.com

2. Alternate Manufacturer: Soprema 310 Quadral Drive , Wadsworth, Ohio 44281. 800-356-3521. Web Site: www.soprema.us

a. Alternate product: Soprema Colphene H-EV, with all associated system components.

3. Alternate Manufacturer: Carlisle Coatings & Waterproofing 800-527-7092 (Addendum 1)

a. Alternate product: Carlisle Waterproofing CCW-500R

4. Alternate Manufacturer: Barrett Company, Millington, NY 07946 800-647-0100 (Addendum 3)

a. Alternate product: Ram-Tough 250 Rubberized Asphalt Membrane

2.2 MATERIALS

A. Membrane

1. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the CGSB-37.50-M89 standard and other pertinent physical properties:

a. American Hydrotech, Inc., Monolithic Membrane 6125EV (minimum 25% post-consumer recycled-content)

PROPERTY	TEST METHOD	TYPICAL RESULT
Flash point	ASTM D-92 CGSB-37.50-M89	<500°F* (260°C)
Penetration	ASTM D-5329 CGSB-37.50-M89	98 mm @77°F (25°C) 187 mm @122°F (50°C)

Flow (60°C)	ASTM D-5329 CGSB-37.50-M89	1.0 mm @ 140°F
Toughness	CGSB-37.50-M89	16.0 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	0.069
Water Vapor Permeability	ASTM E-96, PROCEDURE E CGSB-37.50-M89	0.3 ng/Pa(s)M^2
Water Absorption	CGSB-37.50-M89	.11 gram weight gain
Low Temperature Flexibility (-25°C)	CGSB-37.50-M89	No delamination, adhesion loss, or cracking
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration, flow or low temperature flexibility
Viscosity	CGSB-37.50-M89	11.0 seconds
Water Resistance (5 days/50°C) emulsification,	CGSB-37.50-M89	No delamination, blistering, or deterioration
Softening Point	ASTM D-36	180°F (82°C)
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-3407	40% minimum
Bond to Concrete	ASTM D-3407	Pass 0°F (-18°C)
Acid Resistance	ASTM D-896 Procedure 7.1 (N-8)	Pass-50% Nitric Acid -50% Sulfuric Acid
Resistance to Hydrostatic Pressure	ASTM D-08.22 Draft 2	100 psi (equals 231 foot of head water)
Resistance to Salt Water emulsification	ASTM D-896 similar 20% sodium chloride sodium carbonate	No delamination, blistering, or deterioration

	calcium chloride	
Resistance to Fertilizer emulsification	ASTM D-896 similar undiluted, 15/5/5, nitrogen/phosphorus/ potash	No delamination, blistering, or deterioration
Resistance to Animal Waste	3-year exposure	No deterioration
Solids Content		100%-no solvents
Shelf Life		10 years (sealed)
Specific Gravity		1.23 + .02

*102°F more than the application temperature recommended by the manufacturer.

B. Reinforcing:

1. 60-mil (1.5 mm) thick, uncured neoprene (heavy duty) reinforcing sheet. - American Hydrotech, Inc., Flex Flash UN□

C. Flexible Flashing:

1. 157-mil (4 mm) thick, torch-grade, modified asphalt, reinforced flashing membrane. - American Hydrotech, Inc., Flex-Flash MB□

D. Protection/Cap Sheet:

1. American Hydrotech, Inc., Hydrocap 160 FR□

E. Adhesives/Sealant:

1. Contact adhesive to bond elastomeric flashing together. - American Hydrotech, Inc., Splicing Cement
2. Contact adhesive to bond elastomeric flashing to an approved substrate. - American Hydrotech, Inc., Bonding Adhesive
3. Sealant to seal elastomeric flashing seam edge. - American Hydrotech, Inc., Lap Sealant

F. Drainage Course / Air Layer:

1. American Hydrotech, Inc. Hydrodrain 300®

G. Insulation:

1. At Pavers and Pedestals – Dow Plazamate, R-38.

H. Cover Board:

1. Provide ½ inch Glass mat faced Roof Board, Dens Deck Prime or equal, on stud wall as backer for monolithic waterproof membrane.

2.3 RELATED MATERIALS

A. Metal counterflashing is required at all vertical membrane terminations.

PART 3 - EXECUTION

3.1 INSPECTION

A. The roofing contractor shall examine all surfaces to receive the roofing assembly to verify it is acceptable and proper for the application of the membrane. Refer to American Hydrotech's Pre-Installation & Application Guidelines.

B. The roofing contractor shall not proceed with the installation of the roof membrane assembly until all roof defects have been corrected.

3.2 PREPARATION

A. Substrate Cleaning:

1. Install fiber glass mat board (1/2" Primed Dens Deck or as approved by membrane manufacturer) over solid plywood structural deck. Extend fiberglass mat board up perimeter walls to receive roofing membrane flashings. Fiber glass mat board surface is to be clean, dry, free of voids, and sharp protrusions.
2. Thoroughly sweep the substrate which is to receive the roof membrane.
3. Substrate shall also be blown clean using an air compressor to remove any remaining loose debris.
4. Final check to determine if substrate has been properly cleaned is to apply a test patch of Monolithic Membrane 6125 to the surface and check its adhesion.

3.3 INSTALLATION

A. Membrane Preparation:

1. The membrane shall be heated in double jacketed, oil bath or hot air melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.
2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 350°F (176°C) and 375°F (190°C).

B. Detailing/Flashing:

1. All detailing and flashing shall be done in accordance with the manufacturer's standard guideline details.
2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.

C. Membrane Application:

1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil minimum (approximately 2.3 mm), into which is fully embedded a layer of the spunbonded polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at an average thickness of 125 mil (approx. 3.2 mm). Total membrane thickness is to be 215 mils average (approx. 5.5 mm), 180 mils minimum.
2. Overlap fabric reinforcing sheet 1-2 inches (25.4 mm - 50.8 mm) with membrane between sheets.

D. Separation/Protection course shall be installed as follows:

1. Embed the Hydroflex 30 & HRII separation/protection course into the membrane while it is still hot to insure a good bond. Installation of a separation course is necessary in order to carry out the water test.

a. Overlap adjoining sheet edges (dry) a minimum of 2"-3" (50.8 mm - 76.2 mm) to insure complete coverage.

3.4 WATER TEST

A. The roof area or portions thereof shall be leak tested by means of electronic testing or by ponding water at a minimum depth of 2" (50.8 mm) for a period of 48 hours to check the integrity of the membrane installation.

B. VERIFY that the structure can support the deadload weight of a watertest before testing.

C. If leaks should occur the water shall be drained completely and the membrane installation repaired.

D. Retest roof at no additional cost to the Owner.

END OF SECTION 07556

dj: January 4, 2017

SECTION 076200 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. ~~Manufactured reglets.~~
2. Formed counter flashing; and base flashing
3. Formed roof drainage system.
4. Formed sheet metal downspouts.
5. Formed low-slope roof flashing and trim.
6. Formed wall flashing and trim.
7. Formed ~~window sill flashing pan.~~opening(s) flashing
8. Formed equipment support flashing.
9. Fabrication and installation of roof flashing elements integrated with Division 07 Section “Thermoplastic Membrane Roofing”.
10. Miscellaneous sheet metal flashings.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for installing reglets..
2. Division 04 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
3. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
4. Division 07 Section "Formed Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
5. Division 07 Section “Thermoplastic Membrane Roofing” for roofing accessories installed integral with roofing membrane as part of roofing-system work.
6. Division 07 Section “Roof Accessories” for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
7. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.
8. Division
9. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.
~~7.~~

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners and cleats.
2. Accessories: Full-size Sample.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

~~2.~~

~~1.5~~ 1.6 QUALITY ASSURANCE

~~A.~~D. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

~~1.6~~ 1.7 DELIVERY, STORAGE, AND HANDLING

~~A.~~E. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

~~B.~~F. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

~~C.~~G. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

~~1.7~~ 1.8 COORDINATION

~~A.~~H. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Exposed Finishes: Apply the following coil coating:

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 3-Coat System: Manufacturer's 3-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 621.

b. Color: Manufacture Standard and Custom colors per drawings.

B. Stainless Steel Sheet: ASTM 240 /A240M, Type 304. No. 2D dull, cold rolled finish.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

D. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

~~2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM~~

~~A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.~~

~~1. Available Manufacturers or approved:~~

~~a. Fry Reglet Corporation.~~

~~2. Material: Prefinished galvanized steel, 24 gauge unless otherwise noted.~~
~~3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.~~
~~4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.~~
~~5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.~~
~~6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.~~

~~2.5~~2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Sheet Metal: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

~~2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS~~

G. Gutters: Fabricate in 10' sections to match profiles shown on the Drawings from the following material:
~~Fabricate gutters from prefinished galvanized steel in continuous roll form lengths, of 50 feet maximum, between expansion joints. Joints in gutters not permitted if gutter length is less than 50 feet long.~~

1. Stainless Steel: 22 gauge thick, location per drawings
~~1.~~2. Accessories: Furnish end caps, corner units, downspout outlets, support brackets, spacers, expansion joint covers, baffles and other necessary accessories as required. Furnish from same material as gutters.
~~2. Prefinished coil-coated galvanized steel: Color as indicated on Drawings.~~
3. Expansion Joints: Butt type with cover plate.
4. Gutter Profile ~~and Gauge: As indicated on Drawings.~~per drawings.

~~4.~~H. Downspouts: Schedule 80 PVC as indicated on Drawings. Furnish with metal hangers and anchors as detailed on Drawings.

~~B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers and anchors as detailed on Drawings.~~

~~1. Fabricate downspouts from the following material:~~

~~a. Prefinished coil-coated galvanized steel: Thickness as detailed on Drawings.~~

~~2. Metal hangers: Prefinished, Metallic-Coated Steel: Thickness as detailed on Drawings.~~

~~C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows.~~

~~1. Fabricate conductor heads from the following material:~~

~~a. Prefinished, Metallic-Coated Steel: 0.048 inch thick.~~

~~2.7~~2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

~~A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide, joint cover plates.~~

~~1. Joint Style: Butt, with 12-inch- wide, concealed backup plate.~~
~~2. Fabricate from the following materials:~~

~~a. Prefinished coil-coated galvanized steel: 0.0336 inch thick.~~

~~B.~~A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to

support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners and tees, seal, ~~and solder or weld~~ watertight.

1. Coping Profile: As indicated on Drawings.
2. Joint Style: Butt, with 12-inch- wide, concealed backup plate**.**
3. Fabricate from the following materials:

a. Prefinished coil-coated galvanized steel: 0.0336 inch thick.

~~C.~~B. Base Flashing, counterflashing, flashing receivers and roof-penetration flashings: Fabricate from the following materials:

1. Prefinished coil-coated galvanized steel: 0.0336 inch thick.

~~2.8~~2.6 WALL SHEET METAL FABRICATIONS

A. Openings Flashing in Frame Construction: Fabricate head, sill and similar flashings as detailed. Form head and sill flashing with end dams of height detailed. Fabricate from the following material:

1. Prefinished coil-coated galvanized steel: 0.0336 inch thick.

~~2.9~~2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Prefinished coil-coated galvanized steel: 0.0336 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

G. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel sheet.
2. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Gutters: Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Loosely lock straps to front gutter bead and anchor to rear gutter wall as indicated on Drawings.
2. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Install downspouts using hangers and hardware with spacing as indicated on Drawings.

1. Connect downspouts to underground drainage system indicated.

~~D. Conductor Heads: Anchor securely to wall with elevation of conductor head as indicated on Drawings.~~

~~E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. See Drawings.~~

3.4 ROOF FLASHING INSTALLATION

~~A. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.~~

~~1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at centers as recommended by roofing manufacturer.~~

~~B.~~A. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

~~B. Reglets: Installation of reglets is specified in Division 4 Section "Unit Masonry Assemblies."~~

~~C. Opening Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.~~

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 076616 - ROOF PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Precast concrete roof pavers installed on pedestals.
2. Pedestals, including leveling shims and adjustable pedestals or screwjack pedestals.
3. Clear sealer.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 07 Section “Plaza Roofing System” for waterproof membrane below pavers.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.2 SUBMITTALS

A. Layout Drawings: Submit layout drawings showing typical installation of pavers, including dimensions, field cutting, and other pertinent information. Provide details of adjustable pedestals, including those pedestals where height exceeds standard height of fixed pedestals.

B. Product Data: Submit manufacturer's product data on the following items verifying compliance with specified requirements.

1. Precast concrete pavers.
2. Pedestals, including shims.
3. Sealer.

C. Certification: Submit written certification from the pedestal manufacturer stating that the pedestal assembly will distribute the loads (weight of precast concrete paver and anticipated live loads) without causing structure failure or depressions in the roof cover board or roof insulation.

D. Samples: Submit the following samples:

1. Three (3) sets of precast concrete pavers, 6 inches square in selected color; include the full range of colors to be expected in the completed Work; each set shall contain 3 pavers showing lightest and darkest colors to be expected. Architect's review will be for color and texture only. Seal pavers with clear water repellent sealer, two coats; seal only half of each sample.
2. Samples of fixed height pedestals and screw jack pedestals.

E. Contract Closeout Submittal: Submit the following at time of Project Closeout; include data in "Products Manual" specified in Section 01784.

1. Manufacturer's data on paver, including color pigment, type of aggregates, and finish.
2. Type of pedestals.
3. Type of clear sealer.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications (Pavers): Minimum of 5 years experience in the manufacturing of precast concrete units and fixed and adjustable pedestals of quality specified.

B. Single Source: Obtain precast concrete pavers and pedestals from one manufacturer for the entire Project. All pedestals and accessories shall be obtained from one manufacturer to ensure total system integrity.

C. Installer's Qualifications: Engage experienced Installers who have completed precast concrete paver installations similar in design and extent to that indicated for Project, and who have a minimum of 3 years experience.

D. Tolerances:

1. Fabrication Tolerances: Permissible variations in dimensions shall not differ by more than plus or minus 1/16 inch in width, height, length, thickness, concave or convex deflection.
2. Installation Tolerances: Do not exceed 1/8 inch in 10 feet in any direction from level or slopes indicated when tested with a 10 foot straightedge.

E. Acceptability of Appearance: The following list of finish defects shall be considered as unacceptable and shall be replaced with a new unit at no additional cost.

1. Pavers not being within the approved color range.
2. Non-uniformity of surface texture.
3. Foreign material embedded in the face.
4. Shrinkage cracks.
5. Ragged or irregular edges. Minor defects incidental to the usual method of manufacturer or slight chipping resulting from handling and delivery may be acceptable provided such defects are minor in scope and do not affect the overall appearance of the work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast pavers on wood pallets, covered with non-staining waterproof membrane; allow air to circulate around precast units.

B. Handle precast units to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of precast units with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire ropes or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

1.5 PROJECT CONDITIONS

A. Review installation procedures, and coordinate with other work, and others whose work will be affected by the precast units work.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE PAVERS

A. Type: Modular Paver, light sandblast finish, machine made paver meeting the following requirements:

1. Size: 12 inches by 24 inches by 2 inches thick.
2. Color: As selected from manufacturer’s standards.
3. Finish: Provide manufacturer’s standard light shot finish.
4. Edges: Manufacturer's standard chamfer on top edges (four sides).
5. Weight: Minimum 25 pounds per square foot.

B. Physical Properties:

1. Compressive Strength: Average compressive strength shall be not less than 8,000 psi, with no individual unit less then 7,300 psi at 28 days when tested per ASTM C140.
2. Water Absorption: Average water absorption shall not be greater than 5 percent with no individual unit greater than 7 percent when tested per ASTM C140.
3. Freeze/Thaw: Pavers shall meet the freeze/thaw tests in accordance with Section 8 of ASTM C67. Specimens when tested shall have no breakage and not greater than 1 percent loss in dry weight of any individual unit when subjected to 50 cycles of freezing and thawing.

C. Quality Standard Product: Hanover Prest Roof and Plaza Pavers.

D. Other Approved Manufacturers: The following precast concrete paver manufacturers are approved, subject to meeting the requirements specified: Wausau Tile and Abbotsford Concrete Products Ltd.

2.2 MATERIALS FOR PAVERS

A. Portland Cement: ASTM C150, Type I. White and gray colors may be required to achieve desired finish color. Use only one brand for each type of cement.

B. Aggregates: Normal weight type conforming to ASTM C33, except grading limits shall be as recommended by the paver manufacturer.

C. Color Pigments: Synthetic mineral oxide, sunlight and alkali-fast, conforming to ASTM C979, and certified to be resistant to lime and other alkalis and be compatible with other admixtures which are used in pavers.

D. Provide shop applied sealer.

2.3 PEDESTALS AND ACCESSORIES

A. Type: High density polypropylene pedestals, or approved equal allowing for 3/16 inch spacing between paver units. Pedestal system shall consist of the following:

1. Fixed height pedestals, 3/8 inch high with a base bearing surface of 16 square inches.
2. Standard top leveling disks with incremental adjustment from zero to 5/8 inch per foot; standard base leveling disks to compensate for substrate slope of up to 1 inch per foot; leveling disks shall be high density polypropylene.
3. Provide manufacturer’s standard PVC pad shims, 1/16 inch thick.
4. Provide manufacturer’s standard screw jack pedestals where height from top of roof substrate to underside of paver exceeds height required for fixed pedestals utilizing shims and/or leveling disks.

    a. Screw jack pedestals shall be fabricated from high density polypropylene.
    b. Base bearing surface shall be minimum 50 square inches with rotating base having minimum 3/16 inch wall thickness.
    c. Top unit, 5/32 inch thick with bearing surface area of minimum 26 square inches.

B. Quality Standard Product: Hanover Elevator Pedestal system.

2.4 SEALER

A. Sealer Type and Manufacturer: ProSoCo, Inc. "Consolideck Saltguard", or approved equal siloxane type formulation, having minimum solids of 10 percent and which produces a "natural" appearance when dry. Shop apply.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine areas where installation of precast concrete pavers will occur with Installer present. Verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Commencement of work constitutes acceptance of conditions.

3.2 PROTECTION

A. General: The roofing system shall be fully protected from damage during paver installation. Do not set pavers directly on roofing system without providing protection sheet. Method of protection shall be the responsibility of the Installer.

3.3 INSTALLATION, GENERAL

A. Do not use precast units with chips, cracks, voids, stains, or other defects which might be visible in the finished work. Before setting precast units, examine units for conformance with specified fabrication tolerances and appearance standards; units not meeting requirements shall be rejected.

B. Use power driven masonry saws for cutting of pavers; provide clean, sharp, unchipped edges; cut to provide pattern indicated and to fit adjoining work neatly; accurately form corners. All cut pavers which abut other pavers shall have the top edges cut to maintain the 1/4 inch chamfer edges.

C. Maintain surface plane for finish pavers not exceeding a tolerance of 1/8 inch in 10 feet when tested with a 10 foot straightedge.

D. Clean sub-base to remove dirt, dust, debris, and loose particles.

3.4 PAVER INSTALLATION

A. General: Install pavers on pedestals following layouts and patterns as indicated on drawings. After starting point and finish elevations have been determined, the pedestal system elevation (less paver thickness) shall be established and marked around the perimeter using a laser leveling device.

1. Follow pedestal manufacturer’s recommendations for laying out pedestals to ensure a square layout.
2. Set pavers one row at a time with all joints in alignment and uniform in both directions.
3. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units where full units are shown on drawings.

B. Place pedestals with projecting ribs facing upwards to insure uniform 3/16 inch paver joint spacing. Adjust pedestals so that precast paver has bearing on all four (4) corners. All installed pavers shall be free from “rocking”.

1. Shim spacers with leveling plates as required to meet the installation tolerances as specified. Rubber pedestals may be interlocked and stacked a maximum of three (3) high, unless otherwise recommended by manufacturer.
2. Provide adjustable paver pedestals as required to achieve a uniform installation. Do not extend screw cylinder beyond the minimum engagement of the threads. Overall height of piers shall be as required to maintain proper elevation within plus or minus 1/8 inch in 10 feet.

3. Provide 1 inch by 4 inch by 1/4 inch thick dense neoprene pads where pavers abut vertical surfaces. Adhesively apply pads to pavers; provide a minimum of 3 pads per paver, equally spaced.

3.5 CLEANING

A. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective pavers. Remove and replace all defective pavers as directed, or pavers which do not match adjoining pavers as intended.

3.6 SEALING

A. General: Surfaces shall be completely dry and clean to permit uniform penetration. Seal all pavers.

B. Application: Apply sealer to pavers in one application in accordance with manufacturer's directions using roller to ensure thorough saturation. Do not dilute or alter material.

1. Before applying sealer to an entire area, do a test sample with 24 hour cure time to determine best method of application and coverage rate. Pavers may require a second application depending upon surface porosity; allow a minimum of 24 hours between applications.
2. Do not allow sealer to stand in puddles on paver surface; apply sealer so that treated surfaces remain wet for a few minutes before penetrating; broom out all puddles.

END OF SECTION 077600

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof curbs.
2. Equipment supports.
3. Roof Hatches.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for metal vertical ladders for access to roof hatches.
2. Division 05 Section "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Division 06 Section "Rough Carpentry" for wood nailers.
4. Division 07 Section “Thermoplastic Membrane Roofing” for roof membrane systems.
5. Division 07 Section “Sheet Metal Flashing and Trim” for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

B. Store off ground and handle to keep clean, dry and protected from damage due to weather and construction activities.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.

OR

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.

2.2 MISCELLANEOUS MATERIALS

A. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

B. Polyethylene Sheet: 6-mil- (0.15-mm-) thick, polyethylene sheet complying with ASTM D 4397.

C. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

D. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

2.3 EXPOSED FINISHES

A. High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

1. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:

a. Humidity Resistance: 2000 hours.
b. Salt-Spray Resistance: 2000 hours.

2.4 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AES Industries, Inc.
b. Curbs Plus, Inc.
c. Custom Solution Roof and Metal Products.
d. Greenheck Fan Corporation.
e. LM Curbs.
f. Metallic Products Corp.
g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
h. Pate Company (The).
i. Roof Products, Inc.
j. Thybar Corporation.
k. Vent Products Co., Inc.

B. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.

1. Finish: Two-coat fluoropolymer.
2. Color: As selected by Architect from manufacturer's full range.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick cellulosic-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.5 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with an integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Load Requirements: Per Mechanical Equipment Schedule.
2. Material: Galvanized steel sheet, 0.052 inch thick or as required by loads imposed.
3. Factory-install continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer’s standard removable counterflashing, fabricated of same metal and finish as equipment support.
5. Fabricate units to minimum height of 8-inches above finished roof, unless otherwise indicated.
6. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.6 ROOF HATCHES

A. Basis of Design Product: The design for the roof access hatch is based on “The Bilco Company”, Models NB (ships ladder access). Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

1. Babcock Davis
2. J.L. Industries
3. Milcor Inc.
4. Nystrom Inc.

B. Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral equipment support mounting flange and lid frame counterflashing. Fabricate with

welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external loads.
2. Type and Size:

    a. Single-leaf lid, Type NB, 30 by 84 inches.
    b. Single-leaf lid, Type NB, 30 by 96 inches.

3. Locations: As shown on Roof Plans.
4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch thick.

    a. Finish: High-performance organic coating.

5. Insulation: Glass-fiber Polyisocyanurate board.
6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
8. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
9. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
10. Hatchway Safety Rail System: Bilco “Ladder Up” Hatch Safety Post, Model LU-4:

    a. Material and Finish: Mill finish aluminum.
    b. Tubular post shall lock automatically when fully extended.
    c. Safety post shall have controlled upward and downward movement.
    d. Release lever shall disengage the post to allow it to be returned to its lowered position.
    e. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14” (356mm) on center and clamp brackets to accommodate ladder rungs up to 1-3/4” (44mm) in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof

accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb and Equipment Support Installation:

1. Set roof curb or equipment support so top surface of roof curb is level.

3.3 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 077200

SECTION 078413 – THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items:

1. Floors.
2. Roofs.
3. Walls and partitions.
4. Smoke barriers.
5. Construction enclosing compartmentalized areas.

B. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete” for construction of openings in concrete slabs and walls.
2. Division 21 Sections specifying fire-suppression piping penetrations.
3. Divisions 22 and 23 Sections specifying piping and duct penetrations.
4. Divisions 25 through 28 Sections specifying cable and conduit penetrations.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building System.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

    a. Penetrations located outside wall cavities.
    b. Penetrations located outside fire-resistance-rated shaft enclosures.
    c. Penetrations located in construction containing fire protection-rated openings.
    d. Penetrating items larger than inches (100 mm) diameter nominal pipe size or 16 sq. in. (100 sq. cm) in overall cross sectional area.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

3. STC Rated Partitions: Where UL rated walls also have acoustical requirements, provide the STC properties of the submitted firestopping materials necessary to meet the acoustical requirements.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 LEED SUBMITTAL REQUIREMENTS:

A. Complete the LEED VOC Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

B. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" and experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, ITS or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) ITS in its "Directory of Listed Products."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated on Drawings that are available from the following manufacturers:

1. A/D Fire Protection Systems Inc.
2. DAP Inc.
3. Firestop Systems Inc.
4. Grace, W. R. & Co. - Conn.
5. Hilti Construction Chemicals, Inc.
6. Instant Firestop Mfg. Inc.
7. International Protective Coatings Corp.
8. Isolatek International.
9. Nelson Firestop Products.
10. NUCO Industries.
11. RectorSeal Corporation (The).
12. Specified Technologies Inc.
13. 3M Fire Protection Products.
14. Tremco.
15. United States Gypsum Company.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Paintable Sealants: Provide paintable firestop sealants for locations that are visible in public spaces.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

L. Rock Wool Insulation: Non-combustible, lightweight, semi-rigid stone wool batt insulation to ASTM C665 Type 1, that provides fire resistance to ASTM E136 and sound control to ASTM E423.

1. Manufacturer: ROXUL INC., 420 Bronte Street South, Suite 105, Milton, Ontario, L9T 0H9, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@roxul.com,
2.
a. Fire performance:
b.
1) Non-combustibility: To ASTM E136.
2) Surface Burning Characteristics: To ASTM E84.
3) Flame spread: 0.
4) Smoke developed: 0.
5)

M. Elastomeric Coating: Used in combination with Rock Wool Insulation to seal edge of floor and wall structure to building envelope systems at exterior margins of the building.

1. 3M™ FireDam™ Spray 200, for providing up to 2-hour fire protection for through-penetration systems per ASTM E 814 (UL 1479) & CAN/ULC-S115.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.5 VOC LIMITS

A. Refer to VOC limit tables in Section 018119 for VOC limits for products in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: “Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage.”
2. Contractor’s name, address and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer’s name.
6. Installer’s name.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems

immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

1. Other third party testing agencies are acceptable provided that they are recognized by the appropriate code officials within the jurisdiction of this project, i.e.:

a. (OPL) Omega Point Laboratories
b. (ITS) Intertek Testing Services
c. Other

B. Firestop Systems with No Penetrating Items:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 0001-0999.
2. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Silicone sealant.
c. Intumescent putty.
d. Mortar.
e. Rock wool w/ elastomeric coating.

C. Firestop Systems for Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 1001-1999.
2. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Silicone sealant.
c. Intumescent putty.
d. Mortar.

D. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 2001-2999.
2. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Silicone sealant.
c. Intumescent putty.
d. Intumescent wrap strips.
e. Firestop device.

E. Firestop Systems for Electrical Cables:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 3001-3999.

2. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Silicone sealant.
    c. Intumescent putty.
    d. Silicone foam.
    e. Pillows/bags.

F. Firestop Systems for Cable Trays:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 4001-4999.
2. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Intumescent putty.
    c. Silicone foam.
    d. Pillows/bags.
    e. Mortar.

G. Firestop Systems for Insulated Pipes:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 5001-5999.
2. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Intumescent putty.
    c. Silicone foam.
    d. Intumescent wrap strips.

H. Firestop Systems for Miscellaneous Electrical Penetrants:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 6001-6999.
2. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Intumescent putty.
    c. Mortar.

I. Firestop Systems for Miscellaneous Mechanical Penetrants:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 7001-7999.
2. Type of Fill Materials: One or both of the following:

    a. Latex sealant.
    b. Mortar.

J. Firestop Systems for Groupings of Penetrants:

1. UL-Classified Systems: F-A; F-B; W-J; W-K; W-L; -- 8001-8999.
2. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Mortar.
c. Intumescent wrap strips.
d. Firestop device.
e. Intumescent composite sheet.

END OF SECTION 078413

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK

A. The extent of each form and type of joint sealer is indicated on drawings and by provisions of this Section.

B. The applications for joint sealers as work of this section include the following:

1. Wall joints (exterior).
2. Interior wall/ceiling & wall/floor joints.
3. Other miscellaneous locations where materials meet in abutting conditions.

C. Related Sections:

1. Division 01 Section “Quality Requirements” for Mock-ups.
2. Refer to Division 07 Sections for coping/roofing sealants; not work of this section.
3. Refer to Division 08 Section "Glazing" for requirements; not work of this section.
4. Refer to Division 09 Section "Gypsum Board Assemblies for acoustical sealant requirements; not work of this section.
5. Refer to sections of Divisions 21-23 and 26-28 for joint sealers in mechanical and electrical work; not work of this section.
6. *Division 04 Section “Unit Masonry Assemblies” for mockup that requires work of this section. (Addendum 2)*

D. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, handling/installation/curing instructions, and performance tested data sheets for each elastomeric product required. Certified copies of independent lab test reports shall be provided to verify that products supplied meet specified performance characteristics.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver and stored packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage of contamination to materials by water, freezer, foreign matter or other causes.

1.5 JOB CONDITIONS

A. Weather Conditions: Do not proceed with installation of liquid sealants under wet or unfavorable weather conditions. Install elastomeric sealants when temperature is above 40 degrees F and is in lower third of temperature range recommended by manufacturer for installation.

1.6 WARRANTIES

A. Provide written 5 year warranty by installer specific to this project for each type of joint sealer used. Material warranty by manufacturer shall be provided for 20 years.

1.7 INSTALLER QUALIFICATIONS

A. Installers shall have a minimum of 5 years of specialized experience in sealer applications.

PART 2 - PRODUCTS

2.1 CAULKING FOR INTERIOR USE

A. Product: Acrylic latex base, capable of being painted.

B. Manufacturer: A.C. Horn, Vulcatex of H.; Sonneborn, Sonolac; Bostik Siliconized Acrylic Latex, or approved.

C. Color: Selected from manufacturer's standard color to best match adjacent materials.

2.2 SEALANT FOR EXTERIOR USE

A. Vertical joints at doors, windows, etc. in concrete masonry, exposed steel channels, metal panels, trim and flashings: Exposure: NT - Joint Substrates: M, G, and A. Sealant Types: M. Grade: NS. Class 25. Acceptable Products Are: Bostik: “Chem-Calk 500,” Bostik: “ChemCalk 505 Solvent Free,” Sonneborn: “Sonolastic NP’s,” Tremco: “Pymeric Plus” or approved equal.

B. Vertical joints in glass to glass to other non-porous/non-alkaline material: Exposure NT. Joint Substrates: G and O. Sealant Type S. Grade NS. Class 25. Acceptable Products Are: Dow “795,” Sonneborn “Sonolastic Omniplus,” Tremco “Spectrum II.”

C. Horizontal joints for expansion and joints between dissimilar materials/assemblies. Exposure: T. Joint Substrates M, A, and O. Sealant Type: M. Grade: P. Class 25. Acceptable Products Are: Tremco: “THC 900”.

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Backer Rod: Provide compressible rod stock of closed cell polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, closed cell, nonabsorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type that will not be deteriorated by sealant application temperature as indicated. Shall be nonabsorbent to liquid water and gas, non-out-gassing in un-ruptured state and with diameter 40% greater than the joint width.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back or joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable

2.4 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer: Provide type of non-corrosive & non-staining joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Sealant Backer Rod (S-BR): Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, closed cell, nonabsorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type that will not be deteriorated by sealant application temperature as indicated.

2.5 VOC LIMITS

A. Refer to VOC limit tables in Section 018119 for VOC limits for products in this section.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed, and must notify Contractor in writing of unsatisfactory conditions.

B. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants or caulking compounds. Remove dirt, insecure coatings, moisture and other substances which could

interfere with seal of gasket bond of sealant or caulking compound. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

B. Priming: Apply primer to contract surfaces to be sealed in accordance with manufacturer's directions; apply proper primer compatible with sealant material; apply full strength and undiluted in uniform coating over surface. Prior to proceeding with sealing work, primer and seal representative joints of each type encountered on the project as selected by Architect and Owner; demonstrate adhesion and other performance characteristics for the inspection and approval of Architect and Owner prior to proceeding with work. Protect adjacent work from staining by primer or sealant. Mask as required.

3.3 INSTALLATION

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

B. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated.

C. Joint Backing: Install backer rods and filler material in accordance with manufacturer's directions; provide in as long lengths as practicable; stretch and force into joints with proper tool; install to uniform depths as indicated. Install filler material in joints to receive sealant where joints are 1/2" or more in width and in joints to receive sealant where joint are 3/4" or more in depth. Install backer rods in all other joints to receive sealant.

D. Sealing of Joints: Before applying the final sealing materials, replace any masking torn or damaged and verify that surfaces are properly primed and ready for application of the material.

E. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt. Apply material with tools and equipment designed for its application; filling all joints and voids solid, superficial pointing with skim bead will not be accepted. Leave all joints completely sealed watertight.

F. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.4 CURE AND PROTECTION

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize increases in modulus of elasticity and other accelerated aging effects. Replace or restore sealants which are damaged or deteriorated during construction period.

B. Upon completion remove and dispose of markings materials: remove any excess sealing materials, clean adjacent surfaces of any soil or stain resulting from sealing operations.

END OF SECTION 079200

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel doors.
2. Steel door frames.
3. Sidelight frames.
4. Borrowed-light frames.

B. Related Sections

1. Division 04 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Finish Hardware" for door hardware for hollow metal doors.
3. Division 08 Section “Glazing” for glazing assemblies to be installed in doors and frames.
4. Division 09 Section “Painting” for field painting hollow metal doors and frames.
5. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. For the following items, prepared on Samples about 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 LEED SUBMITTAL REQUIREMENTS:

A. Complete the LEED VOC Submittal Form as provided in Section 013323 – Submittal Procedures – LEED Submittals for products in this section.

B. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10B, UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Steelcraft; an Ingersoll-Rand company.
4. Stiles.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143/M. Cement based grout only.

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Point 12, compounded for 15 mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.

1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edges, 1/8 inch in 2 inches (3 mm in 50 mm).
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from 14 gauge (0.067 inch, 1.7 mm) metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded.

C. Interior Frames: Fabricate door and interior borrowed light frames from 16 gauge (0.053 inch, 1.3 mm) cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld full profile, including flush face joints; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

7. Provide 16 gauge grout guard cover box with electric conduit knockouts for each electric hardware component.

E. Hollow metal doors set in masonry jambs shall be fully grouted. All other exterior doors shall be filled with rock wool insulation.

F. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08, Section "Finish Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

H. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 VOC LIMIT

A. Refer to VOC limit tables in Section 018119 for VOC limits for products in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening unless noted otherwise.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are to be filled with grout.
h. Backcoating for Hollow Metal Frames: Preparation, installation, and coating thickness shall be in accordance with the written instructions of the manufacturer. Remove any overspray from adjacent surfaces.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of expansion anchors if so indicated and approved on Shop Drawings.

3. Mineral Wool: Solidly pack mineral-wool batt insulation behind frames and at center mullions at relites. Rigidly attach doubled jamb studs to hollow metal frames allowing only enough room for drywall to be inserted with a tight fit.
4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces, including sliding barn doors, Dutch doors and partial height doors at locations indicated on the Drawings.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. *Solid-core doors with plastic laminate faces (Addendum 3)*

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 07 Section "Finish Hardware" for door hardware.
3. Division 08 Section "Glazing" for glass view panels in flush wood doors.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

a. Provide samples for each species of veneer and solid lumber required.

b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.
4. *Plastic Laminate door face material. (Addendum 3)*

D. Warranty: Sample of special warranty.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets indicating the bonding agents used for each composite wood and agrifiber product used in the project and demonstrating that no added urea formaldehyde resins are used in these products.

G. A copy of the Chain-of-Custody certificate that was awarded to the wood product manufacturer by the Forest Stewardship Council.

H. An invoice from the wood supplier that states the supplier's Chain-of-Custody number, the quantity and unit costs of all wood purchased, and the associated Chain-of-Custody certification number for all FSC certified wood.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.005 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 LEED REQUIREMENTS

A. The wood content of all products or assemblies must be sourced from a supplier certified by the Forest Stewardship Council (FSC).

B. Composite door, solid core doors, interior plywood, millwork, cabinetry, crown molding, counters, wood panel products used on the interior of the building shall contain no added urea-formaldehyde resins.

C. Adhesives used in field and shop-fabricated assemblies containing these composite wood products shall contain no added urea-formaldehyde resins.

2.2 MANUFACTURERS

A. Manufacturers: Basis-of-Design, VT Industries, Inc. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

a. Algoma Hardwoods Inc.
b. Ampco Products, Inc.
c. Eggers Industries; Architectural Door Division.
d. Lynden Door.
e. Marshfield Door Systems, Inc.
f. Mohawk Flush Doors, Inc.
g. Oshkosh Architectural Door Co.
h. Pacific Architectural Wood
i. Vancouver Door Company, Inc.

2.3 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1.

a. Forest Stewardship Council (FSC) Certified

2. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

D. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

2.4 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).

2. Species: White Maple.
3. Finish: Clear (VT CL07)
4. Cut: Plain Sliced.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by a mullion.
6. Assembly of Veneer Leaves on Door Face: Book-matched, center balance match.
7. Room Match: Provide door faces of compatible color and grain within room or area of the building.
8. Exposed Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces.
9. Core: Particleboard or structural composite lumbar.
10. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.5 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer’s standard shape.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08, Section "Glazing."

2.7 FACTORY FINISHING

A. General: Comply with AWI’s “Architectural Woodwork Quality Standards Illustrated” for factory finishing.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: Manufacturer's standard finish with performance comparable to AWI TR-6 catalyzed polyurethane system.
3. Effect: Semifilled finish.
4. Sheen: Satin.

2.8 PLASTIC LAMINATE FACED DOORS (Addendum 3)

A. Interior Solid Core Doors

1. Grade: Premium
2. Plastic Laminate Faces: High pressure laminates complying with NEM LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: As indicated in drawings, to match wood veneer door faces, or as selected by Architect from laminate manufacturer's full range of products.
4. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Finish Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering

unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.

2. Comply with NFPA 80 for fire-rated doors.
3. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
4. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 081520 - INTEGRATED DOOR SYSTEMS

PART 1 - GENERAL

1.1 GENERAL NOTE

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes

1. Integrated GRP door systems.

B. Related Sections:

1. Division 08 Section "Finish Hardware" for door hardware not supplied in the Section.

1.3 SYSTEM DESCRIPTION

A. Integrated GRP door opening assemblies with doors, operating hardware, accessories, and installation for a complete assembly.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, including installation instructions.

B. Shop Drawings: Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.

1. Indicate each door and frame condition; frame type, profile and installation detail; items of finish hardware, finishes and electrical rough-in requirements.

C. Samples: Submit manufacturer’s samples of the following sliding door components:

1. GRP door panel corner, 6-inch by 6-inch of specified thickness, with two sides exposed to reveal internal construction.
2. Frame section showing interior insulation and finish.

D. Warranty Documentation: Submit manufacturer’s standard warranty.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of integrated GRP doors and frames.

B. Source: Obtain integrated GRP doors, frames and hardware from single source.

C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

1. Notify manufacturer immediately of any shipping damage.

B. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Quality Standard Product: GRP Hygienic doors as manufactured by DORTEK, One Boston Place, Suite 2600, Boston, MA 02108
Website: http://www.dortek.com. Phone: 617-401-8226.
Email: us-sales@dortek.com

2.2 INTERIOR SLIDING GRP INTEGRATED DOORS

A. Door Description: seamless glass-fiber reinforced polyester molded around non-organic hi-density closed cell core.

1. Quality Standard: Dortek Type K sliding door.
2. Size: As indicated on drawings.

B. Door and frame Construction:

1. Core: High density closed cell C.F.C. and H.F.C. free core.
2. Facing: Seamless molded polyester, 1 tenth inch (2.5mm) thick.
3. Door thickness: 1-1/2 inch (40mm).
4. Finish: Smooth, non-porous gelcoat with built in color selected from manufacturer's standard palate.
5. Hardware: Stainless steel pull handles
6. Track: Aluminum rail system with nylon bearings.
7. Canopy: Stainless steel with sloping top.
8. Guide: Internal bottom track with nylon guide.
9. Vision Lite Glazing: Acrylic outer panes finished flush with both faces of door. Nominal 12 inch by 24 inch (300mm x 600mm) opening.

C. Door Operation: Manual

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall openings to receive integrated GRP doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.

B. Verify dimensions of wall openings.

C. Examine surfaces to receive top and bottom guide.

D. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install integrated GRP doors in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install doors plumb, level, square, and in proper alignment.

C. Install doors to close against walls without gaps

D. Install doors to open and close smoothly.

E. Anchor door tracks securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

3.3 ADJUSTING

A. Adjust GRP doors for proper operation in accordance with manufacturer's instructions.

B. Adjust GRP doors to operate smoothly without binding.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

3.4 CLEANING AND PROTECTION

A. Clean GRP doors and components promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage materials or finish.

C. Protect installed GRP doors from damage during construction.

END OF SECTION 081520

SECTION 083113 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.
2. Refer to Mechanical and Electrical drawings for locations of access doors required to service/maintain equipment and services. Access doors indicated on those drawings are to be provided as work of this Section.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 04 Section “Unit Masonry Assemblies" for blocking out openings for access doors and frames in masonry.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation for review by Architect and Engineer.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Sheet: Uncoated ASTM A 36/A 36M cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

C. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis of Design Product: The design for the access doors is based on “J.L. Industries,” Model No. TM, WB, or FD. Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved.

1. Babcock-Davis.
2. Milcor Inc.
3. Nystrom, Inc.
4. Stiles Custom Metal

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces as shown on plans or as directed by Architect.

a. FD Model in rated construction.
b. WB Model in Gypsum Board construction.

2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.

4. Hinges: Continuous piano style.
5. Latch: Cam latch operated by ring turn with interior release.
6. Lock: Mortise cylinder.
7. Size: 24 x 24 inches or as shown on drawings.
8. Allowance: Provide ten (10) non-rated access doors for use in miscellaneous locations in addition to those access doors already shown on the drawings. Size as required to suit conditions, up to 22” x 22”.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 inch wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all doors alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install wall access panel with exposed frame surface mounted to face of gypsum wallboard.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

dj/July 17, 2017

SECTION 083616.13 – INTERIOR SLIDING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Sliding Barn Doors – Wood with vision lite, aluminum with glass, aluminum frames and related hardware.

1.2 RELATED SECTION

A. Division 08 Section “Flush Wood Doors” for wood door panels.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, including installation instructions.

B. Shop Drawings: Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.

C. Samples: Submit manufacturer’s samples of the following sliding door components:

1. Aluminum Frame finish sample

D. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

E. Warranty Documentation: Submit manufacturer’s standard warranty.

F. Test Reports: Submit acoustical reports or UL1784 as applicable.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.

B. Source: Obtain sliding aluminum framed doors and hardware from single source.

C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

1.5 REFERENCES

A. ANSI – American National Standards Institute

1. ANSI 156.18 Materials and Finishes
2. ANSI A117.1 Specifications for making buildings and facilities usable by physically handicapped people.

B. BHMA – Builders Hardware Manufacturers Association

C. DHI – Door and Hardware Institute

D. AWS – Architectural Woodwork Standards

1.6 PERFORMANCE

A. Aluminum perimeter frames with integral acoustic seals

B. Soft self-closing mechanism integrated with top track

C. Concealed door guide

1.7 DELIVERY: STORAGE AND PROTECTION

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Notify manufacturer immediately of any shipping damage.

C. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Quality Standard Product: High performance doors as manufactured by AD SYSTEMS, 2201 100th St. SW, Everett, WA 98204.
Website: http://specADsystems.com. Phone: 425-374-1360.
Attn: Estimating: estimating@specADsystems.com

2.2 INTERIOR SLIDING ALUMINUM-FRAMED DOORS AND PARTITIONS

A. Interior Exam Slide Aluminum-Framed Top-Hung Sliding Doors: Model: AD Systems High Performance Sliding Door System by AD Systems.

B. Frame Profiles: Extruded aluminum frame "wrap" frame with integral vertical jamb (stile pocket).

1. Finish: Painted Hardcoat (Kynar) Finish meeting AAMA 2604.
2. Color: Standard Light Sequin 789G048.

C. Door Leafs. All Doors to be factory machined for hardware including pilot and function holes.

1. Reference Division 08 Section "Flush Wood Doors for wood door panels.
2. Aluminum Stile & Rail Door: 3-1/2" stiles plus 1/2" stop.

a. Glazing: Monolithic translucent tempered glass.
b. Option: 10 inch bottom rail

D. Door Components:

1. Single Top Track: AD Systems extruded aluminum track by AD Systems
2. Valances: Extruded aluminum with integral end caps

a. Sloped valance

3. Top Rollers: tandem nylon roller sized to match door weight
4. Concealed Floor Guide: Integral Jamb floor guide by AD Systems
5. Soft-Closer: Soft and self-closing damper mechanism at [one] or [both] sides of door leaf
6. Handles:

a. AD Systems Standard Ladder Pull: 16" long x 1" diameter. Finish: US32D Satin Stainless Steel.

E. Accessories:

1. Office Door Locks: ADA-5 Key Cylinder & 16-inch Ladder Pull.
2. Privacy Door Locks: Standard ADA-2 Thumbturn with Indicator & 16-inch Ladder Pull]
3. Self-Closing Spring Mechanism.
4. Automatic Door Bottom for improved acoustical performance

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.

B. Verify dimensions of wall openings.

C. Examine surfaces to receive top and bottom guide.

D. Do not begin installation until unacceptable conditions are corrected.

E. Base of door side to be flush or minimal. Rubber Base acceptable.

3.2 INSTALLATION

A. Install sliding doors in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install sliding doors plumb, level, square, and in proper alignment.

C. Install sliding doors to close against walls without gaps

D. Install sliding doors to open and close smoothly.

E. Anchor sliding doors securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

3.3 ADJUSTING

A. Adjust sliding doors for proper operation in accordance with manufacturer's instructions.

B. Adjust sliding doors to operate smoothly without binding.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

3.4 CLEANING

A. Clean sliding doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage materials or finish.

3.5 PROTECTION

A. Protect installed sliding doors from damage during construction.

END OF SECTION

SECTION 084113 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Swinging Entrance Doors
2. Exterior Storefront Systems. (Thermally Broken).
3. Interior Storefront Systems

B. Related sections include the following:

1. Division O! Section “Sustainable Requirements.”
2. Division 07 Section “Joint Sealants” for joint sealants installed as part of aluminum entrance and storefront systems.
3. Division 08 Section “Curtainwall” for interior relite system.
4. Division 08 Section “Aluminum Windows” for exterior windows.
5. Division 08 Section "Finish Hardware" for door hardware for storefront doors.
6. Division 08 Section “Glazing.”

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Glazing-to-Glazing Joints: Provide glazing-to-glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.

D. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

E. Wind Loads: Provide entrance and storefront systems, including anchorage, and reinforcing as necessary, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures," whichever are more stringent. See the General Structural Notes for the wind criteria.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.

F. Seismic Loads: Provide storefront systems, including anchorage, capable of withstanding, without failure, the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures," whichever are more stringent. This includes the story drift noted in the General Structural Notes. Refer to the General Structural Notes for seismic design coefficients.

G. Dead Loads: Provide storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

H. Live Loads: Provide storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads without failure of materials or permanent deformation. See Drawings for supporting structural deflection.

I. Air Infiltration: Provide storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

J. Water Penetration: Provide storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa). Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

K. Thermal Movements: Provide storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

L. Structural-Support Movement: Provide storefront systems that accommodate structural movements including, but not limited to, sway and deflection. Refer to General Structural Notes for seismic drift movements.

M. Dimensional Tolerances: Provide storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, and details of components, provisions for expansion and contraction, and attachments to other work.

1. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

D. Installer Certificates: If requested, provide signed by manufacturer certifying that installers comply with specified requirements.

E. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

H. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing storefront systems similar to those required for this Project for a minimum of five years and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of storefront system through one source from a single manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

D. Accessible Entrances: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

G. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

H. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

B. WARRANTY

C. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

D. Special Warranty: For a 5 year period commencing on the date of Substantial Completion the manufacturer agrees to repair or replace components of storefront systems that fail in materials or workmanship within the listed warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Adhesive sealant failures.
c. Cohesive sealant failures.
d. Failure of system to meet performance requirements.
e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
f. Failure of operating components to function normally.
g. Water leakage through fixed glazing and frame areas.

E. Special Finish Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weather.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

B. Basis-of-Design Products: The design for aluminum-framed systems is based on Arcadia system products.

1. Exterior Storefront System: Arcadia System AFG451T thermally broken system to accommodate inch thermal glazing along with various Arcadia accessories as

shown. Subject to approval by Architect, systems must match basis-of-design frame size and all storefront accessories and components shown and noted on details.

2. Storefront Entrance Doors: Arcadia Heavy Duty Medium Stile, MS362HD Series to accommodate 1 inch thermal glazing.
3. Interior Storefront Systems: Arcadia AF175 Series, structurally glazed

C. Products by a manufacturer other than the Basis-of-Design product will be considered only upon prior approval of a pre-bid substitution request made in compliance with Division 01 Section "Product Substitutions and Options." Substitution requests must be accompanied by sufficient detailed documentation to allow the Architect to make a determination that the proposed product provides an equivalent system to the Basis-of-Design product. No post-bid substitutions will be allowed.

1. Alternate Manufacturers:

a. Kawneer Company, Inc.
b. EFCO

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

D. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

F. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants."

G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

H. Aluminum shear block sill anchors.

I. Aluminum sill extensions per details, color to match storefront.

J. Aluminum snap covers per details, color to match storefront.

2.3 COMPONENTS

A. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

D. Attachments at Structural Steel: Provide information on spacing and configuration of support clips to be provided on structural steel members for attachment of storefront members where indicated or required.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

2.4 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated for center set, inside glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation. Sub-sills shall have mechanically attached and back sealed end dams.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's heavy duty glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Medium stile; 3-1/4-inch nominal width.

a. Bottom Rail: Smooth surfaced stile for width of door in area within 10 inches above floor or ground plate.

3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in the hardware schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N)to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.

B. Opening-Force Requirements:

1. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

C. Weather Stripping: Manufacturer's standard replaceable components.

D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

E. Silencers: BHMA A156.16, Grade 1.

2.7 ACCESSORIES

A. Automatic Door Operators: Division 08 Section "Automatic Door Operators."

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads**,** finished to match framing system.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF or FEVE resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 07 Section “Joint Sealants.”

1. Use shear block anchors at sill in lieu of fastening through sill frame member.

E. Coordinate sheet metal flashing and trim installation with details.

F. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

G. Install glazing to comply with requirements of Division 8 Section “Glazing,” unless otherwise indicated.

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
2. Remove excess sealant from component surfaces before sealant has cured.

H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

I. Install perimeter sealant to comply with requirements of Division 07 Section “Joint Sealants,” unless otherwise indicated.

J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.3 ADJUSTING AND CLEANING

A. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113

dj:September 1, 2017

SECTION 084243 – SLIDING CLEAN ROOM ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following type of sliding clean room entrance door systems. Furnish complete aluminum door system, as specified, that has been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1. Interior, single, sliding aluminum automatic clean room entrance door systems with sidelites, door type 'SCR'.

B. Related Work:

1. Division 07 Section 'Sealants' for perimeter sealants and caulking to the extent not specified in this section.
2. Division 08 Section 'Glazing' for materials and installation requirements of glazing for sliding clean room entrance doors
3. ~~Division 08 Section 'Door Hardware' for hardware to the extent not specified in this section.~~ *(Addendum 3)*

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA) 101: Appendix Dissimilar Materials.

B. American National Standards Institute (ANSI): ANSI A117.1: Accessible and Usable Buildings and Facilities

C. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors. (Addendum 3)

D. American National Standards Institute (ANSI): ANSI Z97.1: Safety Glazing Materials Used in Buildings – Methods of a Test.

E. American Society for Testing and Materials (ASTM) B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.

F. National Fire Protection Association (NFPA) 101: Code for Safety to Life from Fire in Buildings and Structures.

G. The Aluminum Association (AA) Aluminum Finishes Manual

1.4 PERFORMANCE REQUIREMENTS (Addendum 3)

A. Compliance with the following:

1. ANSI/BHMA A156.10 American National Standard for Power Operated Pedestrian Doors.

B. Entrapment Force Requirements:

1. Power Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.
2. Sliding doors provided with a breakaway device shall require no more than 50 lbf (222N) applied 1 inch (25 mm) from the leading edge of the lock stile for the breakout panel to open.

C. Automatic door equipment that has been tested and approved for use in an ISO 3 (Class 1) clean room environment.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's complete product and installation data sheets including installation details, material descriptions, dimensions of individual components and profiles, fabrication, operational descriptions and finishes.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections and details, indicating dimensions, materials, and fabrication of doors, frames, sidelites, glazing details, hardware, finish, options and accessories.

C. Samples: Submit manufacturer's samples of aluminum finish.

D. Quality Assurance and Closeout Submittals: Submit the following:

1. Manufacturer's operation and maintenance data.
2. Warranty document as specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

B. Manufacturer's Qualifications: Manufacturer to have minimum (5) five years successful experience in the fabrication of intensive care doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

C. Source Limitations for sliding clean room entrances: Obtain each type of door, frame, and operator specified in this Section from a single source, same manufacturer unless otherwise indicated

1.7 WARRANTIES

A. Manufacturer's Warranty: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.

B. Distributor's Warranty: 1 year warranty: Labor and transportation charges for defective parts replacement.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access control system as applicable. (Addendum 3)

1.9 DELIVERY, STORAGE AND HANDLING

A. Ordering and Delivery: Comply with factor's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Subject to compliance with requirements, provide automatic sliding clean room entrance doors by ~~Besam Versamax, a division of~~ ASSA ABLOY Entrance Systems, Model SL 500 *Clean Room*. *(Addendum 3)*

B. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following::

1. Horton Automatics, a division of Overhead Door Corporation
2. DORMA Automatics; Div. of DORMA Group North America.
3. Stanley Access Technologies; Division of The Stanley Works.

C. Sliding Clean Room Entrance Door Configuration:

1. Single sliding, *fixed sidelite (Addendum 3)* clean room type door system.

a. Configuration: Two equal panel door unit with one operable leave and one sidelite unit.
b. *Emergency Breakaway Capability: Sliding leaf only*. *(Addendum 3)*
c. Mounting: Overhead header installed between jambs.

2.2 ALUMINUM DOORS AND FRAMES

A. Doors and Frames: Extruded Aluminum, Alloy 6063-T5.

1. Door panels shall have a minimum .125 inch structural wall thickness including adjoining horizontal members and perimeter frames where applicable.
2. Door Construction shall be by means of an integrated corner block with 3/8 inch diameter all-thread through bolt from each stile.
3. Glass Stops shall be .062 inch wall thickness and shall provide security function as a standard by means of a fixed non-removable exterior section with glazing to be performed from the interior only. Glazing stops that allow for glass removal from the exterior shall not be deemed as equivalent.

   a. *45 degree sloped horizontal glass stops. (Addendum 3)*

4. ~~Bottom rails shall be provided with a concealed adjustable sweep gasket that is capable of withstanding exposure to 400° F for a minimum of 30 minutes.~~ (Addendum 3)
5. Vertical Stiles shall be narrow stile 2-1/8 inch.
6. Bottom Rails shall be 4 *10 (Addendum 3)* inch.
7. *Gasketing: Slide-in type, replaceable pile non-shedding Santoprene seals retained by the aluminum extrusions. The following types of gasketing are required: complementing gasketing on the joining vertical stiles of the sidelite and sliding door panels, complementing gasketing on the lead edge of the lock stiles of bi-parting doors, gasketing between the carrier and the header, gasketing on the lead edge stile of single slide door panels, gasketing on the pivot stile of breakout sidelite panels, and gasketing on the butt stile of fixed sidelite panels.*
8. *Clean Room Entrances: Automatic door equipment that has been tested and approved for use in an ISO 3 (Class 1) clean room environment. (Addendum 3)*

B. Glass: Glazing shall comply with ANSI Z97.1 ~~and UL 1784,~~ *(Addendum 3)* thickness as indicated.

1. Door Panel and Sidelite Glazing: 1/4" tempered, unless otherwise specified.
2. Glazing Installation: Dry glazing; wet glazing not allowed.
3. See Division 8 Section Glazing for requirements.

C. Door Carriers: Manufacturer's standard carrier assembly that allows vertical adjustment.

1. Carriage Assembly: Carriage bar with two wheel assemblies. Each assembly shall have tandem roller wheels.
2. ~~Roller Wheels: Two (2) steel roller wheel, 2-3/16 inch diameter, per active door leaf for operation over replaceable extruded nylon 6/6 track. Single journal with sealed oil impregnated bearings.~~ *Roller Wheels: Two heavy duty Delrin roller wheels per wheel assembly, for a total of four (4) roller wheels, 1-7/16 inch diameter, per active door leaf for operation over a replaceable aluminum track. Single journal with sealed oil impregnated bearings. (Addendum 3)*
3. Two (2) Self-aligning anti-risers per leaf.

D. Framing Members: Provide clean room entrances as complete assemblies. Manufacturer's standard extruded aluminum framing reinforced as required to support loads.

1. Vertical Jambs shall be 1-3/4 inches by 4-1/2 inches.

E. Header: Closed design extruded aluminum header unit extending full width of entrance unit to conceal door carrier assemblies, and roller track, complete with hinged access panel for service and adjustment.

1. Size: 4-1/2 inches wide by ~~4-3/4~~ *7 (Addendum 3)* inches high.
2. Hinge Point: Continuous hinge at top of header allows for complete access for adjustments.
3. Design: Manufacturer's standard closed header.

~~F. Anti-Static Option: Fabricate sliding clean room entrances to be internally grounded to reduce static shock.~~ *(Addendum 3)*

G. Hardware: Provide manufacturer's standard hardware as required for operation indicated.

~~1. Provide optional elbow switch activator.~~ *(Addendum 3)*
~~2. Flush Bolts: Manual operated flush bolt to secure sidelite panel(s).~~ *(Addendum 3)*
3. Magnetic catch(s) to retain breakout door and sidelite panels in the closed position. (Addendum 3)
4. *Locking hardware shall be provided as indicated. (Addendum 3)*

a. Electrified slide lock shall automatically lock the sliding function of all sliding door panels within the entrance when the door panels are in the closed position.

1) Fail secure operation: Slide lock shall lock the sliding function of the door panels upon loss of power.
2) Exterior jamb mounted key switch to unlock sliding door operation.

H. Guide Track/Threshold: Manufacturer's threshold as indicated.

1. ~~Trackless Design: Floor mounted guide track and threshold not allowed.~~ *Fixed Sidelite Entrance Guide Track: Aluminum guide track integrated in the bottom of the sidelite portion of the sliding automatic door assembly. (Addendum 3)*

2.3 DOOR OPERATORS AND CONTROLS (Addendum 3)

A. Door Operator and Controller:

1. Electro-mechanical controlled unit utilizing a high-efficiency, energy efficient, DC motor requiring a maximum of 3 amp current draw, allowing 5 operators on one 20 amp circuit. The supplied system shall have the capability to operate at

full performance well beyond a brown out and high line voltage conditions (85V – 265V) sensing changes and adjusting automatically. The operator shall allow an adjustable hold open time delay of 0 to 60 seconds and have internal software to incorporate a self-diagnostic system.

B. Microprocessor Control Box:

1. Modular control unit to allow for changing technology. Factory-adjusted configuration with opening and closing speeds set to comply with ANSI/BHMA A156.10 requirements and electronic dampening to reduce wear on drive train. Should the drive train operations deviate from design criteria ranges, Watchdog Control Circuit Monitoring will assume command of the system and shut down the automatic function allowing a secondary supervisory circuit to perform as a backup. Control unit shall allow the following functions:

a. Diagnostics with the ability to produce application data.

2. Mode Selector Control:

a. Multi-position keyed cylinder mode selector control shall allow selection of the indicated functions to be engaged when switch is turned to the appropriate setting.
b. Mode Selector Control Mounting: Control shall be jamb mounted.
c. Mode selector control to allow the following functions:

1) "Off"
2) "Exit Only" one way traffic with automatic operation from the interior.
3) "Two Way Traffic" allowing automatic operation from exterior and interior.
4) "Partial Opening" energy saving door position allows door to automatically adjust opening width based on amount of usage, that is, full open during high use and partial open during low use. The control for this setting is programmable allowing adjustment to both the usage setting and the opening width.
5) "Hold Open" doors activated and held in the full open position.

2.4 ACTIVATION AND SAFETY CONTROL DEVICES (Addendum 3)

A. General: Provide the types of activation and safety devices specified in accordance with ANSI/BHMA standards, for the condition of exposure and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Safety Presence Sensor:

1. Shall be a sliding door sensor utilizing K-band microwave technology to detect motion and focused active infrared technology to detect presence, combined in a single housing surface mounted on each side of the header.

a. *Presence sensor shall remain active at all times.*
b. *The sensor shall communicate with the automatic door operator through a self-monitoring connection that allows the door to go into a fail-safe mode preventing the door from closing in the event of a sensor failure.*

2. *Motion/presence detecting sensors to be field installed and adjusted.*

C. *Knowing Act Activation Device:*

1. *Touchless Sensor Switch: Stainless steel 4-1/2 inch x 4-1/2 inch faceplate, wall mounted, black hand icon graphics, hard wired. Infra-red microburst sensing technology with an adjustable operating range of 1 inch to 28 inches.*

a. *Light ring to provide red-blue-green visual indication of door status.*
b. *See "Door Interlock System" for operation.*
c. *Touchless Sensor Switch: "CM-331/WS-SGLR" by Camden Door Controls (2 required per sliding entrance).*

2.5 DOOR INTERLOCK SYSTEM (Addendum 3)

A. *Locking Hardware: Electrified slide locks shall be connected to the door interlock control system as indicated to allow operation of only one entrance within the interlock circuit at any given time.*

B. *Door Interlock System: Provide an interlock system to interlock three (3) sliding entrances "Door #232," "Door #233" and "Door #234".*

1. *Sequence of operation: The interlock system shall prevent the opening of another interlocked entrance when one of the interlocked doors in the circuit is in the open position.*

a. *The interlock system shall allow operation of a door after all interlocked doors in the circuit are returned to the closed and locked position.*
b. *The resettable emergency push switch shall provide emergency release of an interlocked entrance.*

2. *Door Interlock Components: Provide all components required for a complete operable system including the following:*

a. *Door interlock controller: "ES550" by Electronic Solutions.*
b. *Door position switches: "DPS" by Securitron (1 required per opening).*
c. *Resettable emergency push switch:*

1) *"CM-4085B" with pneumatic timer by Camden Door Controls (1 required per opening unless indicated otherwise).*
2) *"CM-5085PTER" with pneumatic timer by Camden Door Controls (1 required per opening unless indicated otherwise; mounted egress side).*

d. *Power supply: "BPS-24" by Securitron.*

e. Activation Device with red-blue-green visual indication: See "Activation and Safety Control Devices."

1) Red Visual Indicator: A door in the interlock system is in the open position. Activation is not available.
2) Green Visual Indicator: All doors in the interlock system are in the closed position. Activation is available.

2.6 ELECTRICAL (Addendum 3)

A. High-Efficiency DC Motor: Maximum of 3 amp current draw, allowing 5 operators to run on one 20 Amp circuit.

B. Power: Self-detecting line voltage capable control. 120 VAC through 240 VAC, 50/60 Hz, 3 amp minimum incoming power with solid earth ground connection for each door system.

C. Key Impulse Input: Input for card readers or remote activation with independent adjustable hold open delay.

D. Wiring: Separate internal channel raceway free from moving parts.

E. Brown out / high voltage capability: System has capability to operate at full performance well beyond brown out and high voltage line conditions (85 V – 265 V) sensing changes and adjusting automatically.

F. Convenience Battery: Shall be concealed in header and capable of full operation with blackout conditions, including sensor capabilities for minimum of 100 cycles.

2.7 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Structural Header Sections: Minimum 3/16" thickness.
2. Structural Frame Sections: Minimum 1/8" thickness.
3. Structural Panel Sections: Commercial grade.

B. Anodized Finish (for all exposed aluminum surfaces):

1. AAMA 611, Clear, AA- M12C22A41, Class I, 0.018 mm.

C. MicroShield™ antimicrobial silver-based ion, baked-on enamel finish on door pulls.

1. Antimicrobial finish must permanently suppress the growth of bacteria, algae, fungus, mold and mildew by the controlled release of silver ions that attack microbes and inhibit the growth on the treated surfaces.
2. Coating to be EPA registered resulting in a safe and non-toxic finish; chlorinated or synthetic chemical finishes will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Installer must verify that base conditions previously installed under other sections are acceptable for product installation according to manufacturer's instructions. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not start work until all negative conditions are corrected in a manner acceptable to the installer and manufacturer.

B. *Examine roughing-in for electrical source power to verify actual locations of wiring connections. (Addendum 3)*

3.2 INSTALLATION

A. General: Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.

1. Install surface mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets and guides level and true to location with anchorage for permanent support.

B. Dissimilar Materials: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections. (Addendum 3)

D. Glazing: Glaze clean room entrance door panels in accordance with the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and published instructions of sliding clean room entrances manufacturer.

E. Sealants: Comply with requirements specified in division 7 Section "Joint Sealants" to provide weather tight installation.

1. Set thresholds and framing members in full bed of sealant.
2. Seal perimeter of framing members with sealant.

F. *Signage: Apply signage on both sides of each door and sidelite as required by ANSI/BHMA A156.10 and manufacturers installation instructions. (Addendum 3)*

3.3 FIELD QUALITY CONTROL

A. Manufacturers Field Services:

1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

2. *Before placing doors into operation, AAADM certified technician shall inspect and approve doors for compliance with ANSI/BHMA A156.10. Certified technician shall be approved by the manufacturer. (Addendum 3)*

3.4 ADJUSTING

A. Adjust doors and hardware for smooth, safe operation. *Adjust doors in compliance with ANSI/BHMA A156.10. (Addendum 3)*

3.5 CLEANING, ADJUSTMENT AND PROTECTION

A. Cleaning: After installation, installer to take the following steps:

1. Remove temporary coverings and protection of adjacent work areas.
2. Remove construction debris from construction site and legally dispose of debris.
3. Repair or replace damaged installed products.
4. Clean product surfaces and lubricate operating equipment for optimum condition and safety.
5. Comply with requirements in Division 08 Section Glazing for cleaning and maintaining glass

B. Protection: Contractor shall provide adequate protection for door installation through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of substantial completion.

3.6 DEMONSTRATION

A. *Engage a factory-authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of the door. (Addendum 3)*

END OF SECTION 084243

SECTION 084413 – GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 00 and 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conventionally glazed aluminum curtain walls. (Thermally broken).
2. Fixed custom sunshades.

B. Related sections include the following:

1. Division 07 Section “Joint Sealants” for joint sealants installed as part of aluminum curtainwall systems.
2. Division 08 Section :Aluminum Framed Entrances and Storefronts” for interior and exterior storefront and entry doors.
3. Division 08 Section “Glazing.”

C. The work in this Section shall be provided by the same manufacturer and installer as the following Sections:

1. Division 08 Section “Aluminum Framed Entrances and Storefronts”.

D. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide heavy-duty aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferred to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Noise or vibration created by wind and thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.
g. Failure of operating units to function properly.

B. Delegated Design: Design glazed aluminum curtainwall systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: As indicated in Structural notes.
2. Seismic Loads and Seismic Drift: As indicated in Structural notes.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

G. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

H. Thermal Performance: Window submittals shall include – Certified NFRC Product Data for the u-value, solar heat gate coefficient (SHGC) and air leakage (AL).

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Welding certificates.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies. Engineer is to be currently licensed in the State of Washington.

B. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and the State of Washington Amendments.

C. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals and metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through operable and fixed glazing and framing areas.
f. Failure of operating components to function properly, including windows.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed curtainwall system, including framing and accessories, from single manufacturer.

B. Basis-of-Design Curtainwall Product: The design for glazed aluminum curtain-wall systems is based on Arcadia System T500-OPG6000.

C. Basis-of-Design Sunshade Product: The design for fixed sunshades is based on Arcadia Standard Vertical Brise Soleil BSD012 with ¾” x 6” Rectangular Tube (CT7560). Reference drawings for location and configuration.

D. Products by a manufacturer other than the Basis-of-Design product will be considered only upon prior approval of a pre-bid substitution request made in compliance with Division 01 Section “Product Substitutions and Options.” Substitution requests must be accompanied by sufficient detailed documentation to allow the Architect to make a determination that the proposed product provides an equivalent system to the Basis-of-Design product. No post-bid substitutions will be allowed.

1. Alternate manufacturers:

a. Kawneer North America, an Alcoa Company.
b. EFCO

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Sunshade Extrusion Blades and Aluminum Plate: ASTM B211, Alloy 6063-T6

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 611.
3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

E. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

G. Framing Gaskets: As recommended by manufacturer for joint type.

H. Framing Sealants: Sealant and joint fillers for joints within glazed aluminum curtain wall system as specified in Division 7 Section “Joint Sealants.”

I. Glazing Systems:

1. Glazing: As specified in Division 08 Section "Glazing."
2. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
3. Glazing Sealants: As recommended by manufacturer for joint type.

J. Accessory Materials:

1. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
2. Aluminum Snap Covers: Per details on drawings. Color to match curtain wall.
3. Compression Seal Joint: Iso-Flex Compression Seal Joint System C23 Black, with Iso-flex Lube Adhesive, by LymTal International, Inc. Or equal. See details for locations.

2.3 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's “Glazing Manual.”

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Sunshades: All fascia and blades to be 6063-T6 aluminum-extruded members. Outrigger components shall be 6061-T6 aluminum plates.

1. Manufacturer shall allow +/- 1/8” thermal expansion room at each shade to compensate for dissimilar movement between building structure and aluminum sunshade structure. This design shall be incorporated as to not induce self-destructing loads onto either shade or building veneer.
2. No blade fasteners shall be visible after installation of sections. Provide cover plates at each outrigger end to conceal fasteners. Only mounting hardware shall be visible after installation
3. Components to be shop assembled in large practical sections to allow for immediate installation. Sections indicated on shop drawings to be assembled and shipped as units with cover plates and support arms, if required, shipped loose.

2.4 VOC LIMIT

A. Refer to VOC limit tables in Section 018119 for VOC limits for products in this section.

2.4 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF or FEVE resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing curtainwall systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight. Comply with manufacturer's written instructions.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07, Section "Joint Sealants" and to produce weathertight installation.

1. Use shear block anchors at sill in lieu of fastening through sill frame member.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 08, Section "Glazing."

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
2. Remove excess sealant from component surfaces before sealant has cured.

G. Install perimeter joint sealants as specified in Division 07, Section "Joint Sealants" and to produce weathertight installation.

H. Anchor sunshades to building substructure. Maintain manufacturer's recommended tolerances for clips, mounting brackets and shade sections. Set units level, plumb and true to line with uniform joints. Erect sunshades after all adjacent painting, masonry (including chemical treatments), roofing, electrical, glazing, and other similar work is completed above and below the sunshade sections.

I. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

END OF SECTION 084413

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes operable and fixed aluminum-framed windows.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 08 Section “Aluminum Framed Entrances, Storefronts, and Curtainwall” for windows and sunscreens in fenestration systems.
3. Division 08 Section “Sound Control Windows” for special acoustical windows.
4. Division 08 Section “Glazing” for glass and insulated glazing units.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

B. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

C. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.

1. Size indicated on Drawings.

B. Structural Performance: Provide aluminum windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

1. Design Wind Loads: As indicated in Structural Notes in Structural Drawings.

    a. Alternatively, wind loads may be calculated in accordance with ASCE 7-10 Chapter 30 using criteria from general structural notes.

2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.

C. Samples for Verification: For aluminum windows and components required, prepared on Samples of size indicated below.

1. Window Corner Fabrication: 12-by-12-inch long, full-size window corner including full-size sections of extrusions with factory-applied color finish, weather stripping, and glazing.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.

G. Maintenance Data: For operable window sash, operating hardware and finishes to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.6 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for aluminum windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 01, section "Product Substitutions and Options; Substitution Request Form." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials,

components, accessories, and fabrication. Comply with more stringent requirements if indicated.

1. Provide AAMA certified aluminum windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of metals, other materials, and metal finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: Two years from date of Substantial Completion.
b. Metal Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arcadia
2. Kawneer North America, an Alcoa Company

3. EFCO

B. Quality Standard Product: Arcadia T200 Series.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.

B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, Brake Shapes, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2/NAFS.

E. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 WINDOW

A. Window Type: Projected and Fixed, see drawings for locations.

1. Arcadia T200 Series thermal heavy commercial fixed and awning windows, 2-inch depth.

B. AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS.

1. Performance Class and Grade: AW-PG95-P & AW-PG135-FW.

C. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to NFRC 100.

1. U-Factor: 0.43 Btu/sq. ft. x h x deg F or less.

2.4 GLAZING

A. Glass and Glazing Materials: Refer to Division 08, Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

2.5 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907 or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide *clear anodic satin aluminum finish. (Addendum No. 2)*

B. Cam Lock and Four-Bar Friction Hinges (Bronze Alloy): Comply with AAMA 904.

C. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.

1. Safety Devices: Limit clear opening to 4 inches for ventilation; with custodial key release.

D. Projected Awning Windows: Provide the following operating hardware:

1. Lock: Lift-type throw, cam-action lock with keeper; two per ventilator.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. All windows shall be capable of receiving up to 1 inch glass assemblies.

C. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.

D. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

F. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08, Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08, Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: Kynar black matte (no gloss.)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window operating system. Refer to Division 01, Section "Operations and Maintenance Data" for Owner training requirements.

3.5 FIELD QUALITY CONTROL

A. Installed products to be cleaned and adjusted for proper operation immediately prior to testing.

B. Window installation to be tested by qualified independent testing agency for water penetration resistance.

C. Window manufacturer is to be present during testing.

D. Test installed windows for compliance with performance requirements for water penetration in accordance with ASTM E 1105 cyclic pressure and as follows:

1. Cyclical pressure testing to be performed to FOUR cycles of 5 minutes each as described in referenced standard.
2. Window system: 8.00 psf
3. Number of Tests: Minimum of three (3) of each type of storefront and entrance or as required to achieve compliance with manufacturer's published performance ratings.

    a. First Test: Take at initial installation.
    b. Second Test: Take at 50% completion.
    c. Third Test: Take at 80% completion.
    d. If any windows fails, test additional windows at Contractor's expense.

E. On-site tests for water infiltration will be performed as described herein.

1. Correct deficiencies in units, which fail to meet specified requirements, and units having similar deficiencies. Defective units to be retested.
2. Test windows, including perimeter joint and interface with adjacent building construction.

F. Field QA/QC Testing:

1. Testing to be conducted on interior seals, typically window to wall interface.
2. Test randomly selected window units during installation process in general accordance with ASTM E 1105.

    a. Test location and volume to be determined at discretion of Architect.

END OF SECTION 085113

SECTION 085653 - SECURITY WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sliding, transaction security windows.

1.3 COORDINATION

A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, weights and finishes for window units.

B. Shop Drawings: For security windows.

1. Include plans, elevations, sections, and attachment details.
2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
3. Hardware for sliding window units.
4. Glazing details.
5. Details of transaction counter.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

1. Framing: 12-inch- long sections of frame members.

D. Cutaway Sample: Corner of security window, made from 12-inch lengths of full-size components, and showing details of the following:

1. Joinery.

2. Anchorage.
3. Glazing.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of security window and accessory indicated as ballistics or forced-entry resistant, for tests performed by a qualified testing agency.

B. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

2. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label security window packaging with drawing designation.

C. Store crated security windows on raised blocks to prevent moisture damage.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including deflections exceeding 1/4 inch.
b. Failure of welds.
c. Faulty operation of sliding window hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:

1. Ballistics Resistance: Level 1 when tested according to UL 752.

2.2 SLIDING, TRANSACTION SECURITY WINDOWS

A. Provide sliding, transaction security windows.

1. Quality Standard Product: InterbankX Model ATX-T4-4836

B. Configuration: One fixed-glazed panel and one horizontal-sliding glazed panel.

C. Operation: Manual open/self-closing.

D. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:

1. Profile: Manufacturer's standard, with minimum face dimension indicated.

a. Minimum Face Dimension: 1-1/2 inches.

2. Depth: 5 inches

E. Head and Jamb Framing: Designed for sealant glazing. Removable header access panel on secure side.

F. Sill: High pressure laminated plastic shelf 12 inches deep by width of security window, with integral stainless steel deal tray.

G. Sliding Window Hardware: Provide roller track designed for overhead support of manufacturer's standard carrier supporting horizontal-sliding glazed panel with manufacturer's standard self-closing mechanism mounted in header]. Provide manufacturer's standard pull and lock with two keys for each horizontal-sliding glazed panel.

H. Glazing and Glazing Materials: Bullet Resistant Polycarbonate.

1. Glazing Meeting Edges: Polished glazing.

I. Materials:

1. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.

2. Aluminum Extrusions: ASTM B 221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength.
3. Aluminum Sheet and Plate: ASTM B 209.

2.3 FABRICATION

A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.

1. Provide units that are reglazable from the secure side without dismantling the attack side of framing.

B. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.

1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.

C. Glazing Stops: Finish glazing stops to match security window framing.

1. Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.
2. Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.

D. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

E. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

2.6 ACCESSORIES

A. Recessed Deal Trays: Formed from stainless steel fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.

1. Clear Opening Size: 12 inches wide by 8 inches deep by 1-1/2 inches high.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

C. For factory-installed glazing materials whose orientation (secure or attack side) is critical for performance, verify installation orientation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same ballistics-resistance performance as security window.

B. Glazed Framing: Provide gasket-glazed framing. Comply with installation requirements in Section 088853 "Security Glazing."

C. Removable Glazing Stops and Trim: Fasten components with security fasteners.

D. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose.

3.3 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

3.4 ADJUSTING

A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.5 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

1. Lubricate sliding security window hardware.

B. Clean glass of preglazed security windows promptly after installation.

C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain operable security windows.

END OF SECTION 085653

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes dome unit skylights with formed curb counterflashing with integral prefabricated roof curbs.

B. Related Sections include the following:

1. Division 07 roofing section for flashing and roofing terminations at unit skylight curbs.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit skylights, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure.
4. Dimensional tolerances of building frame and other adjacent construction.

B. Structural Loads:

1. Wind Loads: As indicated by structural design data on Drawings.
2. Snow Loads: As indicated by structural design data on Drawings.
3. Concentrated Live Loads: 250 lbf applied to framing members at locations that will produce greatest stress or deflection.
4. Seismic Loads: As indicated by earthquake design data on Drawings.
5. Load Combinations: Calculate according to requirements of applicable code indicated on Drawings.
6. Opening Protection: Design and engineer skylights to provide opening protection and fall restraint in compliance with Washington OSHA without the use of guardrails or screens.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Unit Skylight Standard, Dynamic Dome model CE-4 certified to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS-11 or previous) as follows:

1. Performance Grade (Primary Designator): SKP-PG30 1670 x 2885 (66 x102)

2. Design Pressure (DP): Minimum DP = +/- 30 psf (+/- 14.40 KPa). Dome shall not invert at positive design pressure.

3. Water Test Pressure: Minimum 4.6 psf (220 Pa) with no leakage at 5 gallons per minute spray rate.

4. Air Leakage Rate: Maximum 0.05 cfm/ft^2 (0.3 L/s/m^2)

E. Daylighting: Provide daylighting photometric performance comparable to basis of design product at layout indicated, based upon daylighting profile of March 21, 9:00 am local time, at Project location by simulation in accordance with IESNA guidelines.

F. Air Infiltration: Maximum air leakage through tested size of 0.05 cfm/sq. ft. (0.3 L/s/sq. m) of fixed area as determined according to ASTM E 283 at a static-air-pressure differential of 1.57 lbf/sq. ft. (75Pa.)

G. Water Penetration under Static Pressure: No evidence of water penetration through unit when tested according to ASTM E 331 at a static-air-pressure differential of 4.6 lbf/sq. ft. (220 Pa).

H. Fire Testing for Roof Assemblies with Fire Classifications: Unit skylight tested in accordance with and listed as passing Class B Burning Brand test as described in ASTM E 108.

I. Dome Burn Rate: Tested in accordance with ASTM D 635 with a documented rating of CC1.

J. Dome Smoke Density Rating: Testing in accordance with ASTM D 2843 with a documented performance value less than or equal to 75.

K. Dome Self-Ignition Temperature: Tested in accordance with ASTM D 1929 with a documented performance value greater than or equal to 650 degrees Fahrenheit.

L. Dome Hail Resistance: Exterior dome tested in accordance with Factory Mutual 4430 to meet severe hail with 2.0 inch ice balls.

M. Energy Performance ratings for any size commercial curb mounted unit skylight with dynamic dome as follows:

1. Thermal Transmittance: NFRC 100 maximum U-factor:

a. Double Dome: IR Block Smooth Acrylic (3I2W2): 0.44

2. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC:

a. Double Dome: IR Block Smooth Acrylic (3I2W2): 0.30

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal-framed skylights.

B. Shop Drawings: For unit skylights. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the State of Washington responsible for their preparation.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each framing intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing – glass is not required to match the specified glazing
5. Flashing and drainage.
6. Building skylight Thermal break design

F. Field quality-control test and inspection reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit skylights.

H. Preconstruction Test Reports: For unit skylight assemblies.

I. Maintenance Data: For unit skylights to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work, of this Section, with a minimum of three (3) years' experience installing work of similar magnitude and complexity, and who is acceptable to manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for skylights' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including testing conducted by an independent testing agency and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Final As Approved Record Shop Drawings after obtaining them in the field

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, dome, and other materials beyond normal weathering
b. Breakage of polycarbonate glazing.
c. Water leakage.

2. Warranty Period:

a. 15 years from date of Substantial Completion for polycarbonate dome for hail breakage from hail stones 2 inches diameter and less. Mill finished aluminum skylight frames.
b. 10 years: yellowing of acrylic and polycarbonate skylight domes.
c. 5 years: Acrylic and impact modified acrylic dome skylights, model CDS with polycarbonate dome, aluminum curbs, external safety cage, internal safety screen accessory, internal security bars accessory, ventilation curb extension.
d. 1 year: steel curbs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for metal-framed unit skylights is based on Velux America LLC, Dynamic Dome skylight model CE4. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Wasco Skylights
2. Bristolite Skylights

2.2 SYSTEM DESCRIPTION

A. Dome with integral insulated aluminum curb**,** fixed skylight utilizing extruded aluminum frame counter-flashing with welded corners, an interior 100% thermally broken gasket for condensation drainage, structural sealant, and accessories, as required to meet installation and performance requirements indicated. Dynamic dome skylights shall be suitable for installation on roof curbs ranging from 0 degrees up to 60 degrees from horizontal.

1. Basis of Design: VELUX America LLC, Model CE4-6072-3I2W2 Dynamic Dome Skylight.

B. Dome: Height 30% of skylight width, vacuum formed with precise repeating geometric patterns, and overall shape to maximize strength and daylight at low solar elevation angles 10 to 40 degrees. Outer dome shall be formed from smooth sheet and not prismatic in order to transmit all incident daylight through outer dome. Initial rise of the dome shall be at an angle of at least 60 degrees to horizontal in order to harvest daylight at low solar elevation angles 10 through 40 degrees. Provide polycarbonate domes with integral UV blocking cap layer that prevents long-term yellowing, and insures material strength and performance stability. Light diffusion 100%.

1. Energy Dome: Outer dome clear 0.118 Dynamic IR Block Smooth Acrylic / 16 mm White Multiwall Polycarbonate.

C. Aluminum Frame Counter-flashing: Maintenance-free, extruded aluminum, grade 6063-T5, 0.06 inch (1.5 mm) thick with neutral grey powder coat finish. Counter-flashing frames completely welded in corners and counter flashes curb a minimum of 1.625 inches (41 mm). Provide aluminum frame with at least 0.75 inch (19 mm) continuous ledge on each side of the skylight that is a pinch free access for stacking, manual transportation and mounting of skylights.

1. Unit Size: 60 inches by 72 inches

D. 100% Thermally Broken Gasket for Condensation Drainage: Factory applied black thermoplastic gasket encapsulating the entire interior aluminum frame assembly providing a thermal break weather seal and drainage for condensation. The gasket design shall allow positive condensation to the exterior of the curb without exposed drainage openings in the aluminum frame that can introduce air infiltration into the skylight. The thermally broken gasket construction shall allow for a dry installation of skylight to the curb, eliminating weather seal strips or caulking at the top of the curb.

E. Structural Sealant: Factory applied silicone sealant, gray color, bonding the dome to the aluminum frame and suitable for external exposure.

2.3 CURBS

A. Aluminum Curb: Factory insulated aluminum curb, 1.5 inches in thickness with 20-gauge mill finished aluminum exterior and 22-gauge mill finished aluminum interior. Curb factory insulated with 1.5 inches of polyisocyanurate board providing an R-value of 8.5. Width and length of curb shall be 6072 with 16-inch curb height. Curb roof mounting flange shall be a minimum 2.75 inches in width.

1. Basis of Design: VELUX America LLC, Model CCAM. Skylight shall be attached to curb prior to shipping.

2.4 MATERIALS

A. Joint Sealants: As specified in Division 7 Section "Joint Sealants."

B. Mastic Sealants: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit skylights in accordance with manufacturer's written instructions and approved shop drawings. Coordinate installation of units with installation of substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that finished installation is weather tight. Comply with manufacturer’s written instructions.

B. Where metal surfaces of unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

C. For custom flashings, install unit skylight curb counter-flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed skylights with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 CLEANING AND PROTECTION

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Replace glazing that has been damaged during construction period.

C. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION 086200

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SECTION ~~083613~~ 086613 - SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following types of sectional overhead doors.

1. Electrically operated motorized sectional overhead service doors.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 05 Section “Metal Fabrications” for door opening jamb and head support members.
3. Division 08 Section “Access Doors and Frames” for access doors.
4. Division 08 Section “Finish Hardware” for cylinder core to match building system.
5. Division 11 “Loading Dock Accessories” for dock bumpers, seals, overhead door track protector, and interior bollards.
6. Division 26 “Electrical” for wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

D. Provide complete operating door assemblies including door curtains, guides, counterbalance mechanisms, hardware, and installation accessories.

E. Electrical Subcontractor to furnish the following for power operated units: Line fuses and main line disconnect. All wire, conduit and boxes for the aforesaid items and also for the motor operator, key operated control station, limit switches and accessory items, i.e. Automatic Reversing Control, and/or any other as may be specified.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead door. Include manufacturer's operating instructions and maintenance data.

B. Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed in manufacturer's data. Indicate opening dimensions

and required tolerances, jamb connection details, anchorage spacing, hardware locations, installation details, and special conditions.

C. Samples for Initial Selection: Provide manufacturer's finish charts showing full range of colors and textures available for units with factory applied finishes.

1. Include similar samples of accessories involving color selection.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Provide O&M documentation for sectional overhead doors per Division 01 Section "Submittal Procedures" and Division 01 Section "Operations and Maintenance Data."

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide sectional overhead doors from a company specializing in the manufacturing of products specified in this section and with a minimum of five years' experience

B. Installer Qualifications: Installer shall be authorized and qualified to install overhead door systems on the type and scope of project specified.

C. Provide each sectional overhead door as a complete unit produced by one manufacturer, including frames, sections, brackets, guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit the openings and head room allowable.

D. Unless otherwise acceptable to Architect, furnish sectional overhead door units by one manufacturer for entire project.

E. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Provide setting drawings, templates, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

F. Wind Loading: Design and reinforce sectional overhead doors to withstand a 20 lb. per sq. ft. wind loading pressure.

1.6 PROJECT CLOSEOUT

A. Warranty:

1. Provide a one-year warranty signed by the manufacturer for the installation and materials of the door. Warranty period to commence on day of Substantial Completion.

PART 2 - PRODUCTS

2.1 SECTIONAL OVERHEAD DOOR MANUFACTURER

A. Subject to compliance with requirements, provide products of one of the following:

1. Kinnear, Div. Harsco
2. Northwest Door, Inc.
3. Overhead Door Co.
4. Raynor Manufacturing Co.
5. Clopay Building Products Co
6. CHI Overhead Doors

B. Basis of Design Product: Overhead Door Company Model 591 Thermacore Door System with motorized operating system.

2.2 DOOR MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate sectional overhead door to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide panels of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows.

1. Galvanized Steel Sheet: Galvanized commercial steel, (CS type) per ASTM A653/A653M, G90 and G60 coating class.
2. Panels: Metal/foam/metal sandwich panel construction with PVC thermal break and weather-tight ship-lap design.

a. Panel Thickness: 1-5/8 inches.
b. Exterior Surface: Ribbed
c. Exterior Sheet: .016 inch hot-dipped galvanized
d. End Stiles: 16 gauge

3. Insulation: Foamed in place, CFC/HCFC free polyurethane.

a. R-Value: 14.86, U-Value: 0.067

4. Air Infiltration: 0.08 cfm/sf at 25 mph,
5. Finish: Baked on Kynar polyvinylidene fluoride high performance coating.

B. Door Configuration and Operation.

1. Weather Stripping: EPDM flexible bulb type strip at bottom section, flexible jamb seals and header seal.
2. Track: Provide track as recommended by manufacturer to suit loading required and clearances available. Minimum standards include:

    a. 3 inches wide, roll-formed 13 gauge galvanized steel, with galvanized steel mounting brackets.
    b. Lower track sections adjustable for weathertight fit.
    c. Horizontal tracks reinforced with minimum 13 gauge galvanized steel angle according to door weight and size

3. Track Configuration Type: High lift
4. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor

    a. High cycle spring: 50,000 cycles

5. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL 325/2010 requirements for continuous monitoring of safety devices.

    a. Sensing Edge Protection: Electric sensing edge monitored to meet UL 325/2010.
    b. Operator Controls: Push-button operated control stations with open, close, and stop buttons. Controls located at the interior, surface mounted, with conduit encased wiring from control to motor.

6. Locking: Interior slide bolt lock for electric operation with interlock switch.
7. Insulated Vision Lites: Full glazed aluminum sash panels with ½ inch tempered insulating glass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the work.

B. Examine locations of electrical connections.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install door, track, and operating equipment complete with necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions and as herein specified.

B. Fasten vertical track assembly to framing at not less than 24" o.c. Hang horizontal track from structural overhead framing with angle or channel hangers, welded and bolt-fastened in place. Provide sway bracing, diagonal bracing, and reinforcing as required for rigid installation of track and door operating equipment. Paint track and mounting brackets per Division 09 Section “Painting.”

C. Upon completion of installation, including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

END OF SECTION 083613

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hardware for wood and hollow steel doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors for which hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping, seals and door gaskets.

1.2 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

D. NFPA 80 - Standard for Fire Doors and Other Opening Protective; 2016.

E. NFPA 101 - Life Safety Code; 2015.

F. UL (BMD) - Building Materials Directory; current edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. See Division 01 Section “Project Meetings” for pre-installation meeting procedures.

B. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Convey Owner's keying requirements to manufacturers.

F. Pre-installation Meeting: Convene a pre-installation meeting one week prior to commencing work of this section; require attendance by all affected installers.

1. Prior to commencement of hardware work, schedule meeting with Owner, Contractor, Contractor's field superintendent, hardware installer, and other interested parties to review methods and procedures to be used to achieve end results.

G. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.4 SUBMITTALS

A. See Division 01 Section "Submittal Procedures" for submittal procedures.

B. Product Data

1. Hardware: Manufacturer's specifications, maintenance and keying manual, and installation instructions of finish hardware. Include photographs, marked templates and other data required to show compliance with these specifications.

C. Finish Hardware Schedule.

1. Format: Comply with scheduling sequence and vertical format in DHI's (Door & Hardware Institute) "Sequence and Format for Hardware Schedule." Double space entries and number/date each page.
2. Content:

a. Identification number, location, hand, fire rating, degree of opening, and material of each door and frame.
b. Type, style, function, size, quantity, and finish of each door hardware item.
c. Include description and function of each lockset and exit device.
d. Complete designations of items required for each door or opening including name and manufacturer.
e. Fastenings and other pertinent information on attachment of hardware.
f. Explanation of abbreviations, symbols and codes contained in schedule.
g. Mounting locations for door hardware.
h. Include separate schedule of key and master key system.

3. Approval of this list by Architect does not relieve Contractor of responsibility to provide finish hardware components required for complete operating installation.

D. Keying Information: Provide keying and bitting information to Owner.

E. Cut sheets: 1 set of manufacturer cut sheets for each hardware item supplied.

F. Templates/Diagrams:

1. Deliver templates of approved finish hardware items compatible with other Work.
2. Electrical diagrams, including riser and point to point hook-up for each door with electrified hardware.

G. Shop Drawings:

1. Indicate locations and mounting heights of each type of hardware, catalog cuts, electrical characteristics and connection requirements.
2. Submit manufacturer's parts lists and templates.

H. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

J. Maintenance Materials and Tools:

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Provide ten extra key lock cylinders for each master keyed group.
3. Provide special wrenches and tools applicable to each different or special hardware component.
4. Provide maintenance tools and accessories supplied by hardware component manufacturer.

K. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Provide services of an AHC or DHI member of Door Hardware Institute to:

1. Be available for consultation with Architect/ Owner at no additional cost to Owner during progress of construction.

B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 5 years of experience.

1. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.
2. Hardware consultant must be an employee of supplier.

C. Hardware supplier shall have and maintain a factory direct status with manufacturers specified or approved during course of project.

D. Where several manufacturers are specified for one type of hardware, use only products of one manufacturer.

1.6 REGULATORY REQUIREMENTS

A. Hardware to comply with applicable local and/or State fire and current building codes.

B. Hardware installed at doors with U.L. fire-resistant rating to meet required rating.

C. Doors installed for smoke protection to receive hardware as recommended by NFPA.

D. Provide hardware per requirements of Building Code for fire door assemblies labeled for fire resistance and smoke control ("S" label).

E. Electric equipment to have U.L. approved listing for complete assembly.

F. Comply with requirements of ANSI A117.1. and The Americans with Disabilities Act (ADA) and State Building Code regarding access for disabled.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Individually package each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on outside to indicate contents and specific locations in Work.

B. Provide experienced employee designated to receive, take charge of, and distribute hardware at building site, and provide locked area for storage of hardware.

C. Protect from damage. Store above ground and under cover.

D. Stockpile items sufficiently in advance to assure proper and adequate provision in Work of those trades for interface with Work of this Section.

1.8 WARRANTY

A. See Division 01 Sections "Closeout Procedures" and "Warranty Procedures" for additional warranty requirements.

B. Warrant operation of Mortise locksets for Lifetime Mechanical and 5 years for Mortise Deadlocks

C. Warrant operation of closers for Lifetime Mechanical.

D. Warrant operation of exit devices for 5 years.

1.9 CERTIFICATION

A. Prior to Substantial Completion Date, provide written certificate that hardware is complete and conforms to Specifications and approved submittals.

1.10 CLOSEOUT SUBMITTALS

A. As specified in Section 01 78 00.

B. Operating Tools: Furnish adjusting tools

C. Keys: Stamp keys for identification and deliver to Owner. Furnish keys for each lock as specified. Use of final keys will not be permitted during construction.

1. Delivery of Hardware: Deliver in unopened containers fully identified with manufacturer's name, number and finish.
2. Furnish each set of keys in separate envelopes packed in temporary key control cartons; do not pack with locks; use envelopes furnished by key control manufacturer. Type each envelope with key cut number, keying data, and location

D. Operation and maintenance data for review and approval.

1. Operation and maintenance data for hardware.
2. Final typed finish hardware schedule that includes any corrections and changes to submittal schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Best Access Solutions: Stanley, Best, Precision www.bestaccess.com.

B. Assa Abloy Group: Pemko, Rockwood www.assaabloydss.com

C. Select Hinges and TIPIT® Hospital Tips: www.select-hinges.com

D. Trimco, originally called Triangle Brass Manufacturing Co., Inc: www.trimcohardware.com.

E. KeyWatcher: Morse Watchmans www.info.morsewatch.com

F. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with following:

1. Applicable provisions of Federal, State, and local codes.
2. 36 CFR 1191, ADA Standards for Accessible Design.
3. ADA Standards and ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
4. Applicable provisions of NFPA 101, Life Safety Code.
5. Fire-Rated Doors: NFPA 80.

6. Hardware on Fire-Rated Doors: Listed and classified by UL (BMD) as suitable for purpose specified and indicated.
7. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of applicable code.
8. Products Requiring Electrical Connection: Listed and classified by UL (BMD) as suitable for purpose specified and indicated.

2.3 HARDWARE FINISHES

A. Produce finishes as stated herein. Finishes of same designation, which come from more than one source, shall match when items are viewed at arm's length and approximately 2 feet apart.

1. Unless otherwise specified, match finish of each item of hardware with finish selected for lock sets and latches.

2.4 GENERAL

A. Fasteners:

1. Furnish necessary flat head screws, bolts, and other fasteners of suitable size and type to anchor hardware in position for long life under hard use.
2. Where necessary, furnish fasteners with expansion shields, sex bolts, and other anchors as required and recommended by hardware manufacturer.

    a. Toggle Bolts: Not permitted.

3. Provide fasteners that match hardware finish and material.
4. Conceal if possible when door is in closed position; provide exposed fasteners with Phillips head.

    a. Through-bolting not permitted.

B. Locks and Latches: Verify:

1. Operation
2. Hand of doors
3. Function for each opening.

C. Closers: Verify for each door:

1. Hand of door
2. Degree of opening
3. Frequency of use
4. Head condition.

    a. Provide closers which do not limit door swing.
    b. Furnish drop plates for narrow top rails.

c. Furnish manufacturer's standard one piece cast arm at parallel arm location.
d. Furnish closers at fire-resistant rated doors, exterior doors and elsewhere as shown.

D. Furnish silencers for door frames at rate of 3 for each single door and 2 for each door or pair of doors; except gasketed doors and doors with light seals or sound seals.

1. Furnish gaskets for rated doors to corridors or other exit ways.

E. Furnish door stops in number and type to protect finishes wherever doors or hardware could strike adjacent surfaces and materials.

F. Hardware Locations:

1. Mount hardware at recommended location of manufacturer or per requirements of ICC A117.1.

2.5 KEYING

A. Factory or locally key following:

1. Furnish Best Cormax patented keying for exterior doors and Best SFIC Standard 7-pin for interior doors to match Owners existing systems
2. Meet with Owner to determine specific keying requirements.

a. Furnish keying schedule within 10 days of key meeting for Owner review and approval.

B. Furnish nickel silver keys for each lock as follows:

1. 3 change keys per cylinder.
2. 6 master keys for each set.
3. 3 grand-master keys (if applicable.)

C. Construction Keying:

1. Furnish a construction key system with 10 keys for locks and cylinders: 7 for Contractor and 3 for Owner.
2. Use only construction keys during construction.
3. Upon Substantial Completion of Work, void construction key system and, in presence of Architect and Owner, demonstrate specified keying system is operating properly.

D. Identification and delivery:

1. Stamp permanent keys, "DO NOT DUPLICATE".
2. Provide “Serialization” of keys

E. Key Control:

1. Re-use existing double in vestibule 100.
2. Provide a new Keywatcher single in West Stair S2 on the east wall.

2.6 PRODUCTS

A. Single Source:

1. Except as specifically otherwise approved in advance by Architect, furnish for each item only product of a single manufacturer.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Locks and Latches:

1. Mortise Type Locks and Latches:

a. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
b. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
c. Provide 9001-Quality Management and 14001-Environmental Management.
d. Fit ANSI A115.1 door preparation
e. Functions and design as indicated in the hardware groups
f. Solid, one-piece, 3/4-inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel
g. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
h. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
i. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
j. Provide sufficient curved strike lip to protect door trim. Anti-friction type
k. Lever handles must be of forged or cast brass, bronze or stainless steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
l. Lock shall have self-aligning, thru-bolted trim
m. Levers to operate a roller bearing spindle hub mechanism

n. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
o. Spindle to be designed to prevent forced entry from attacking of lever
p. Provide locksets with 7-pin removable and interchangeable core cylinders
q. Each lever to have independent spring mechanism controlling it
r. Core face must be the same finish as the lockset.
s. Occupancy indicator and lockset assembly to be by same manufacturer and designed for use in this application.
t. Unit to be equipped with ADA thumb turn and have simultaneous retraction of latch and deadbolt when inside lever is turned.

2. Anti-Ligature Levers Behavioral Healthcare Solutions shall include components specifically designed to be used as a complete operational system.

a. Independent, tapered, bidirectional lever
b. Thru-bolted fixed conical escutcheon

D. Exit Devices:

1. Furnish with provisions for concealed mounting.

a. Through-bolts not acceptable unless required by fire codes or fire tests.

2. Include impact resistant, flush mounted end cap.

a. End caps to be of heavy-duty alloy construction and provide horizontal adjustment for flush alignment with device cover plate.
b. No raised edges to protrude from end cap.

3. Furnish with:

a. Hydraulic touch pad dampener for quiet operation of device.
b. Deadlocking latchbolts and roller strikes.

4. Filler Plates: Furnish shim kits for flush mounting of exit devices on doors.
5. Supply plastic installation template.
6. Tested and approved by BHMA for ANSI 156.3 Grade 1
7. Furnish UL or recognized independent laboratory certified mechanical operational testing to 10 million cycles minimum
8. Provide deadlocking latchbolt
9. Touchpad shall be “T” Style
10. Exposed components shall be of architectural metals and finishes.
11. Lever design shall match lockset lever design
12. Provide strikes as required by application
13. Fire exit devices shall be listed for UL10C
14. UL Listed for Accident Hazard

15. Shall consist of a push pad, the actuating portion of which extends across shall no be less than one half the width of the door leaf.
16. Provide vandal resistant or breakaway trim

E. Door Closers:

1. Contractor to advise on submittals which side closers are to be mounted If new installation mount on corridor side if patient area or patient room. Mount inside at storage or non-patient areas.
2. Fasteners: Concealed.
3. Closer to have:

    a. Heavy duty arms.
    b. Adjustable spring power with indicator dial.
    c. Stick-on templates.
    d. Torx Screw
    e. Pressure relief valves: Not permitted.
    f. Delayed action required
    g. Tested and approved by BHMA for ANSI 156.4 Grade 1
    h. Maximum 2 7/16 inch case projection with non-ferrous cover
    i. Separate adjusting valves for closing and latching speed and backcheck
    j. Lifetime mechanical warranty required.
    k. Closers shall be non-handed, non-sized and multi-sized
    l. Conform to ANSI 117.1 ADA requirements
    m. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.

F. Stops:

1. Do not use floor stops unless specifically approved by Architect or shown otherwise.
2. If wall stops cannot be installed in contact with lock/latch half of door leaf, provide concealed or surface overhead holder.

G. Kickplates:

1. Metal, as specified in Door Hardware Groups.
2. Secure with torx brand security screws, spaced uniformly at maximum of 5 inches on center at kickplate perimeter.
3. Kickplates:

    a. 0.050 inch.
    b. Beveled on 4 edges.

H. Armor plates:

1. Metal, as specified in Door Hardware Groups.
2. Secure with torx brand security screws

I. Emergency Release Stop and Double Swing Hinge:

1. ADA and CMS Compliant
2. Secure with torx brand security screws

J. Electronic Key Control: Keywatcher:

1. Patented Smartkey system
2. Integrates with Lenel OnGuard
3. 7" touch screen
4. Modular design

K. Acceptable Manufacturers:

Products:	Manufacturer:	Substitute:
Continuous Hinges:	Select (SEL)	None, Facility Standard
Hospital Tip:	Select TIPIT	None, Facility Standard
Locks/Latches:	Best 40H Series (BES)	None, Facility Standard
Anti-Ligature Levers:	Best SPSL Series (BES)	None, Facility Standard
Emergency Release Stop:	Pemko (PEM)	Or approved equal
Cylinders:	Best (BES)	None, Facility Standard
Exit Devices:	Precision (PHI)	None, Facility Standard
Surface Closers:	Stanley QDC100 (SH)	None, Facility Standard
Concealed Closers:	LCN 2010 (LC)	Dorma, Norton
Stops/Catches:	Trimco (TR)	Don Jo or approved equal
Kickplates:	Trimco (TR)	Don Jo or approved equal
Armor Plate:	Trimco	Don-Jo or approved equal
Flush Pulls:	Trimco (TR)	ABH or approved equal
Weatherstripping/Gasketing:	National Guard (NG)	Pemko or approved equal
Silencers:	Trimco (TR)	Hager or approved equal
Electronic Key Control	Morse Watchman	None, Facility Standard

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions under which Work of this Section will be performed.

1. Correct conditions detrimental to timely and proper completion of Work.
2. Do not proceed until unsatisfactory conditions are corrected.

B. Protect work of others from damage.

3.2 COORDINATION

A. Coordinate with other trades to assure proper and adequate provision in Work of those trades for interface with Work of this Section.

3.3 INSTALLATION

A. Install Work accordance with:

1. Hardware groups specified.
2. Approved Schedule.
3. Applicable requirements of governmental agencies having jurisdiction.
4. Manufacturer's and referenced standard's recommended installation procedures.

B. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

C. Mounting heights for hardware from finished floor to center line of hardware item:

1. For hollow metal doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
2. For hollow metal doors and frames: See Section 08 11 13.
3. For Wood Doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."
4. Wood Doors: See Section 08 14 16.

D. Accurately locate, fit and install square, plumb and true.

1. Provide hairline fit at joints
2. Securely fasten.

E. Cut and fit threshold or floor plates to door frame profile and with mitered corner joints; weld multiple pieces together and set in full bead of sealant.

1. At carpet, install closer floor plates flush with structural substrate under carpet.
2. Secure to substrate with positive anchoring devices.

F. After fitting mortised hardware to surfaces to be painted, remove and store hardware in original package in secure place until painting is completed, then install permanently.

3.4 CLEANING, ADJUSTMENT, AND PROTECTION

A. Clean, without damaging, exposed surfaces affected by work of this Section and repair as necessary.

B. Remove from site refuse created by this Work, and dispose of in legal manner.

C. Remove protective coating completely from exposed surfaces as soon as progress of Work permits with safety.

D. Properly wrap hardware subjected to hand usage during construction for protection; hardware finish damaged through carelessness to be replaced at no expense to Owner.

E. Upon completion of Work, and as condition of its acceptance, provide inspection, and adjustment.

1. At time of Substantial Completion, during and at end of warranty period, test, adjust and where necessary lubricate moving parts including keyways for free, smooth and quiet operation.

a. Lubricate locks with fine powdered graphite only.

2. After ventilation system is balanced, hardware manufacturer's representative to adjust closers as necessary to meet ADA and Building Code regarding time required for closing operation and force required to open and provide written report pertaining to overall operation and installation of hardware.

3.5 FINISH HARDWARE GROUPS

~~SET #01~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Push Plate~~	~~1001-3~~	~~630~~	~~TR~~
~~1~~	~~Pull Plate~~	~~1018-3~~	~~630~~	~~TR~~
~~1~~	~~Door Closer~~	~~QDC111 SN x Torx screws~~	~~689~~	~~SH~~
~~1~~	~~Armor Plate~~	~~KO050 42" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~1~~	~~Mop Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

SET #~~02~~ 01 (door opening 125, 128)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D ST~~
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D ST
1	Push Plate	1001-3	630 TR
1	Pull Plate	1018-3	630 TR
1	Door Closer	QDC111 SN x Torx screws	689 SH
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx	630 TR
1	Wall Bumper	1270CVPV x Torx	626 TR
3	Door Silencers	1229A	BLACK TR

SET #02~~A~~ (door opening B23, B24, B28)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D ST
1	Push Plate	1001-3	630 TR
1	Pull Plate	1018-3	630 TR
1	Door Closer	QDC111 SN x Torx screws	689 SH
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx	630 TR
1	Overhead Stop	1020 Series x Torx	US32D AB
3	Door Silencers	1229A	BLACK TR

~~SET #03~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Store Room Lockset~~	~~45H-7D3J PATD~~	~~630~~	~~BE~~
~~1~~	~~Door Closer~~	~~QDC114 SN x Torx screws~~	~~689~~	~~SH~~
~~1~~	~~Wall Bumper~~	~~1270CVPV x Torx~~	~~626~~	~~TR~~
~~1~~	~~Armor Plate~~	~~KO050 42" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

~~SET #03A~~

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Store Room Lockset~~	~~45H-7D3J PATD~~	~~630~~	~~BE~~
~~1~~	~~Door Closer~~	~~QDC114 SN x Torx screws~~	~~689~~	~~SH~~
~~1~~	~~Wall Bumper~~	~~1270CVPV x Torx~~	~~626~~	~~TR~~
~~1~~	~~Armor Plate~~	~~KO050 42" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

SET #~~04~~ 03 (door opening B13,213)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D ST~~
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D ST
1	Passage Set	45H-0N3J	630 BE
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx	630 TR
1	Wall Bumper	1270CVPV x Torx	626 TR
3	Door Silencers	1229A	BLACK TR

~~SET #04A~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D ST~~
~~1~~	~~Hospital Latch~~	~~45H 0N x 6710 ABH~~	~~630 BE~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630 TR~~
~~1~~	~~Door Closer~~	~~QDC111 SN x Torx screws~~	~~689 SH~~
~~1~~	~~Overhead Stop~~	~~9020 Series x Torx~~	~~US32D AB~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK TR~~

SET #~~05~~ 04 (door opening B11, B12, 143 144, 211, 212, 236, 239, 240, 245)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D ST~~
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D ST
1	Office Lockset	45H-7AB3J PATD	630 BE
1	Wall Bumper	1270CVPV x Torx	626 TR
3	Door Silencers	1229A	BLACK TR

SET #05~~A~~ (door opening 145, 213A, 214, 237)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D ST~~
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D ST
1	Office Lockset	45H-7AB3J PATD	630 BE
1	Overhead Stop	1020 Series x Torx	US32D AB
3	Door Silencers	1229A	BLACK TR

~~SET #06~~

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Store Room Lockset~~	~~45H-7D3J PATD~~	~~630~~	~~BE~~
~~1~~	~~Door Closer~~	~~QDC115 SN x Torx screws~~	~~689~~	~~SH~~

1 Overhead Stop	1020 Series x Torx	US32D	AB
3 Door Silencers	1229A	BLACK	TR

SET #07

8 Hinges	FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS	US32D	ST
2 Flush Bolt	W3913	626	TR
1 Dustproof Strike	3911	630	TR
1 Store Room Lockset	45H-7D3J PATD	630	BE
2 Overhead Stop	1020 Series x Torx	US32D	AB
2 Door Silencers	1229A	BLACK	TR

SET #08

3 Hinges	FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS	US32D	ST
1 Office Lockset	45H-7AB3J PATD	630	BE
1 Overhead Stop	1020 Series x Torx	US32D	AB
3 Door Silencers	1229A	BLACK	TR

SET #~~09~~ 06 (door opening 152)

6	Hinges	FBB199 5 X 4 1/2 TORX SCREWS	US32D	ST
1	Exit Device	MLR C 2803 LBR X 1703C	630	PR
1	Exit Device	MLR C 2802 LBR X 1702C	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
~~1~~1	Operator	ED 900PR J8 FWPRS	626	DM
2	Power Transfer	EPT-12C		PR
2	Wire Harness	WH-192		ST
2	Wire Harness	WH-50		ST
2	Power Supply	RPSMLR2BB		PR
2	Wall Switch	WS/RFT 1	630	DM
2	Hand held Trans.	HH/RFT 1 433		DM
~~2~~1	~~Wall Switch~~Receiver	~~WS/RFT 1~~RFR 433	630	DM
2	Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
2	Overhead Stop	1020 Series x Torx	US32D	AB

NOTE: Card reader is provided by the owner's security vendor.
Operation: ~~presenting a valid credential to the card reader outside,~~pressing a wall mounted actuator or using a remote hand held transmitter initiates the low power operators which signal the
exit devices to unlatch to open both door leaves. Authorized use is signaled by the exit devices, and egress is always
free from the inside.

SET #~~10~~ 07 (Dr. O~~door o~~pening B17, B17A, B22, B25, 111, 118, 121, 124, 141, 146, 232, 233, 234, 235, 241)

NOTE: All Hardware is by door manufacturer

SET #~~11~~ 08 (door opening B07)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Exit Device	2103 x ~~1703A x~~ 4903C	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Door Closer	QDC115 SN x Torx screws	689	SH
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx		630 TR
1	Wall Bumper	1270CVPV	626	TR
3	Door Silencers	1229A	BLACK	TR

~~SET #12~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32DST~~
~~1~~	~~Classroom Lockset~~	~~45H-7R3J PATD~~	~~630 BE~~
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626 TR~~
~~1~~	~~Door Closer~~	~~QDC111 SN x Torx screws~~	~~689 SH~~
~~1~~	~~Armor Plate~~	~~KO050 42" x 2" LDW B4E CSK x Torx~~	~~630 TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK TR~~

SET #~~13~~ 09 (door opening B18)

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~
1 Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Sec screw	CL	SP
1 Store Room Lockset	45H-7D3J PATD	630	BE
1 Door Closer	QDC112 x 8Q00470 TJ mount x Torx screws	689	SH
1 Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
1 Wall Bumper	1270CVPV	626	TR
~~3 Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

Gaskets and Seals are by door manufacturer.

SET #~~13A~~ 10 (door opening B10, 220)

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~
1 Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Sec screw	CL	SP
1 Store Room Lockset	45H-7D3J PATD @ Door B10	630	BE
1 Store Room Lockset	45H-7D3J VT PATD @ Door 220	630	BE
~~"Vandal resistant lockset option" @ 220~~			
1 Door Closer	QDC112 x 8Q00470 TJ mount x Torx screws	689	SH
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626 TR~~
~~1~~	~~Armor Plate~~	~~KO050 42" x 2" LDW B4E CSK x Torx~~	~~630~~
~~TR~~			
1 Kick Plate	KO050 8" x 2" LDW B4E CSK x Torx	630	TR
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK TR~~
1 Overhead Stop	1020 Series x Torx	US32D	AB

Gaskets and Seals are by door manufacturer.

SET #~~14~~ 11 (door opening 140)

1 Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Sec screw	CL	SP
1 Classroom Lockset	45H-7R3J PATD	630	BE
~~Add Classroom Lockset~~			
~~1~~	~~Deadlock~~	~~MS1850S~~	~~628 AR~~
~~2~~	~~Cylinder~~	~~1E-74 PATD~~	~~626 BE~~
1 Door Closer	QDC112 x 8Q00470 TJ mount x Torx screws	689	SH
~~1~~	~~Push pull bar~~	~~1737~~	~~630 TR~~
1 Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
~~1~~	~~Overhead Stop~~	~~1020 Series x Torx US32D~~	~~AB~~
1 Wall Bumper	1270CVPV	626	TR

Gaskets and Seals are by door manufacturer.

SET #~~14A~~ 12 (door opening 200)

1	Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Sec screw	CL	SP
1	Deadlatch	4900 x 4591- 01	628	AR
1	Cylinder	1E-74 PATD	626	BE
1	Door Closer	QDC112 x 8Q00470 TJ mount x Torx screws	689	SH
1	Push bar	1741	630	TR
1	Kick Plate	KO050 ~~108~~" x 2" LDW B4E CSK x Torx	630	TR
1	Overhead Stop	1020 Series x Torx	US32D	AB
1	Threshold	325HD x Torx screws	AL	NA

Gaskets and Seals are by door manufacturer.

SET #~~15~~ 13 (door opening B00)

~~8~~	~~Hinges~~	~~FBB199 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
8	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
2	Exit Device	MLR C 2803 LBR X 1703C	630	PR
2	Rim Cylinder	12E-72 PATD	626	BE
1	Operator	ED 900 J8 SW	626	DM
1	Door Closer	QDC111 x 8Q00470 TJ mount x Torx screws	689	SH
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192		ST
1	Wire Harness	WH-50		ST
1	Power Supply	RPSMLR2BB		PR
2	Wall Switch ~~(1 at door B00)~~ DM		WS/RFT 1	630
2	Kick Plate	KO050~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
1	Gasketing Set	137 NA SET x Torx screws (Head & Jambs)		NA
2	Astragal Seal	9125 A		NA
2	Door Sweep	200 NA x Torx screws		NA
1	Saddle Threshold	513 x Torx screws	AL	NA

NOTE: Card reader is provided by the owner's security vendor.
Operation: presenting a valid credential to the card reader outside, initiates the low power operators which signal the
exit devices to unlatch to open both door leaves. Authorized use is signaled by the exit devices, and egress is always
free from the inside. Wall mounted actuator inside for ADA egress. Actuator initiates both the vestibule and exterior
doors.

SET #~~15A~~ 14 (door opening B01)

8	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
2	Exit Device	MLR C 2803 LBR X 1703C	630	PR
2	Rim Cylinder	12E-72 PATD	626	BE
~~1~~	~~Operator~~	~~ED 900 J8 SW 626 DM~~		
1	Door Closer	QDC111 x 8Q00470 TJ mount x Torx screws	689	SH
1	Overhead Stop/Holder	1010 Series x Torx	US32D	AB
~~1~~	~~Power Transfer~~	~~EPT-12C PR~~		
~~1~~	~~Wire Harness~~	~~WH-192 ST~~		
~~1~~	~~Wire Harness~~	~~WH-50 ST~~		
~~1~~	~~Power Supply~~	~~RPSMLR2BB PR~~		
~~2~~	~~Wall Switch (1 at door B0)~~	~~WS/RFT 1 630 DM~~		
2	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
1	Gasketing Set	137 NA SET x Torx screws (Head & Jambs)		NA
2	Astragal Seal	9125 A		NA
2	Door Sweep	200 NA x Torx screws		NA

1 ~~Saddle Threshold~~Safety Tread ~~513~~ 3504 x Torx screws AL NA

~~Add Stop / Holder~~

~~NOTE: Card reader is provided by the owner's security vendor. Operation: presenting a valid credential to the card reader outside, initiates the low power operators which signal the exit devices to unlatch to open both door leaves. Authorized use is signaled by the exit devices, and egress is always free from the inside. Wall mounted actuator inside for ADA egress. Actuator initiates both the vestibule and exterior doors.~~

SET #~~16~~ 15 (door opening 100A, 102A)

2	Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Security screws	CL	SP
2	Dummy Bar	N673DR	630	PR
2	Exit Device Trim	2902A	630	PR
1	Operator	ED 900 J8 SW	626	DM
1	Door Closer	QDC111 x 8Q00470 TJ mount x Torx screws	689	SH
~~1~~	~~Frame Switch~~		~~FS-1~~	~~630 DM~~
~~1~~2	Wireless ~~Wall~~ Switch		~~WS/RFT 1482A1U 630~~	~~DM~~SDC
2	Surface Mount Box	400-1B		SDC
2	Wireless Transmitter	400W1 - 433		SDC
1	Wireless Receiver	400RC - 433		SDC
~~1~~	~~Push a~~Actuator		~~CL2388 x CL2236 mounting box~~	~~630~~ PR
2	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
2	Overhead Stop	1020 Series x Torx	US32D	AB
1	Safety Tread	3504 x Torx screws	AL	NA
~~1~~	~~Saddle Threshold~~	~~513 x Torx screws~~	~~AL~~	~~NA~~

~~NOTE: Card reader is provided by the owners' security vendor.~~
~~Operation: presenting a valid credential to the card reader outside, initiates the low power operators which open both~~
~~door leaves. Wall mounted actuator inside for ADA egress. Actuator initiates both the vestibule and exterior doors.~~
Gaskets and Seals are by door manufacturer.

SET #16~~A~~ (door opening 201)

2	Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Security screws	CL	SP
2	Dummy Bar	N673DR	630	PR
2	Exit Device Trim	2902A	630	PR
2	Door Closer	QDC111 x 8Q00470 TJ mount x Torx screws	689	SH
2	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
2	Overhead Stop	1020 Series x Torx	US32D	AB
~~1~~	~~Saddle Threshold~~	~~513 x Torx screws~~	~~AL~~	~~NA~~

~~SET #17~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32DST~~
~~1~~	~~Store room Lockset~~	~~45H-7D3J PATD~~	~~630 BE~~
~~1~~	~~Overhead Stop~~	~~1020 Series x Torx~~	~~US32DAB~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK TR~~

~~SET #17A~~

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32DST~~
~~1~~	~~Store room Lockset~~	~~45H-7D3J PATD~~	~~630 BE~~
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626 TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK TR~~

SET #~~18~~ 17 (door opening 100, 102)

2	Continuous Hinge	SL57HD EPT PREP W/TIPIT ANTI LIG x Sec sc. ~~rew~~		CL
	SP			
1	Exit Device	MLR C 2603 LBR X 2908A	630	PR
1	Exit Device	2602 LBR X 2902A	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
1	Operator	ED 900 J8 SW	626	DM
1	Door Closer	QDC112 x 8Q00470 TJ mount x Torx screws	689	SH
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192		ST
1	Wire Harness	WH-50		ST
1	Power Supply	RPSMLR2BB		PR
1	Wireless Switch	482A1U		SDC
1	Surface Mount Box	400-1B		SDC
1	Wireless Transmitter	400W1 - 433		SDC
1	Wireless Receiver	400RC - 433		SDC
~~1~~	~~Frame Switch~~	~~FS-1~~	~~630~~	~~DM~~
	~~(exterior doors)~~			
~~1~~	~~Wall Switch~~	~~WS/RFT 1~~	~~630~~	~~DM~~
	~~(vestibule doors)~~			
2	Overhead Stop	1020 Series x Torx	US32D	AB
2	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
1	Saddle Threshold	~~513~~ 325HD x Torx screws	AL	NA

NOTE: Card reader is provided by the owner's security vendor. Card reader or intercom activates auto operator.
Operation: presenting a valid credential to the card reader outside, initiates the low power operator which signals the
exit device to unlatch to open one door leaf. Authorized use is signaled by the exit devices, and egress is always
free from the inside. Actuator inside for ADA egress. Actuator initiates both the vestibule and exterior
doors. Card reader or intercom activates the operator.
Gaskets and Seals are by door manufacturer.

~~SET #19~~

~~1~~	~~Continuous Hinge~~	~~SL57HD W/TIPIT ANTI LIG x Security screws~~	~~CL~~	~~SP~~
~~1~~	~~Privacy~~	~~SPSL-ML-LTF-16F~~	~~630~~	~~BE~~
~~1~~	~~Door Closer~~	~~2010 Series~~	~~689~~	~~LC~~
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626~~	~~TR~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

SET #~~20~~ 18 (door opening 114, 122, 153)

~~1~~	~~Set Pivots~~	~~0147~~	~~-3/4~~	~~SEC~~	
~~US32D~~	~~AB~~				
~~1~~	~~Intermediate Pivots~~	~~019~~	~~-3/4~~	~~SEC~~	
~~US32D~~	~~AB~~				
1	Continuous Hinge	SL57HD EPT PREP W/TIPIT ANTI LIG x Sec sc.	CL	SP	

~~1~~	~~Continuous stainless steel "Swing Clear" hinges~~			
1	Lockset	45H-7TD3J PATD	630	BE
1	Door Closer	QDC115 SN x Torx screws	689	SH
~~1~~	~~Wall Bumper~~		~~1270CVPV~~	
~~626~~	~~TR~~			
1	Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
1	Wall mount Dr. Stop & Holder	1260	626	TR
1	Gasketing Set	137 NA SET x Torx screws	NA	
1	Door Sweep	200 NA x Torx screws		NA
1	Safety Tread	3504 x Torx screws	AL	NA
~~1~~	~~Saddle Threshold~~	~~513 x Torx screws~~	~~AL~~	~~NA~~

SET #~~21~~ 19 (door opening B16)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Store room Lockset	45H-7D3J PATD	630	BE
1	Door Closer	QDC115 SN x Torx screws	689	SH
1	~~Kick~~ Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
1	Wall mount Dr. Stop & Holder	1260	626	TR
~~3~~	~~Door Silencers~~	~~1229A~~		
~~BLACK~~	~~TR~~			
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~22~~ 20 (door opening 206, 210)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Classroom Lockset	45H-7R3J PATD	630	BE
1	Door Closer	QDC111 SN x Torx screws	689	SH
1	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
~~1~~	~~Wall mount Dr. Stop & Holder~~	~~1260~~	~~626~~	
~~TR~~				
1	Wall Bumper	1270CVPV x Torx	626	TR
~~3~~	~~Door Silencers~~	~~1229A~~		
~~BLACK~~	~~TR~~			
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #2~~2A~~1 (door opening 110)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Classroom Lockset	45H-7R3J PATD	630	BE
1	Door Closer	QDC111 SN x Torx screws	689	SH
1	Kick Plate	KO050 ~~10"~~ 8" x 2" LDW B4E CSK x Torx	630	TR
1	Overhead Stop	1020 Series x Torx	US32D	AB
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

~~SET #23~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Passage Set~~	~~45H-0N3J~~	~~630~~	~~BE~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~1~~	~~Wall Bumper~~	~~1270CVPV x Torx~~	~~626~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

SET #~~24~~ 22 (door opening 103, 202)

1	Continuous Hinge	SL57HD W/TIPIT ANTI LIG x Security screws	CL	SP
1	Privacy	SPSL-ML-LTF-16F	630	BE
1	Door Closer	2010 with bumper Series	689	LC
1	Wall Bumper	1270CVPV	626	TR
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx	630	TR

~~3 Door Silencers 1229A BLACK TR~~

1 Smoke Gasket 5050B (Head & Jambs) “Anti-Ligature” BLACK TR

~~SET #25~~
~~8 Hinges FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS US32D ST~~
~~2 Exit Device MLR C 2208 LBR X 4908C 630 PR~~
~~2 Rim Cylinder 12E-72 PATD 626 BE~~
~~1 Set of Operators ED 900PR J8 FWPR 626 DM~~
~~2 Power Transfer EPT-12C PR~~
~~2 Wire Harness WH-192 ST~~
~~2 Wire Harness WH-50 ST~~
~~2 Power Supply RPSMLR2BB PR~~
~~2 Wall Switch WS/RFT 1 630 DM~~
~~2 Kick Plate KO050 48" x 2" LDW B4E CSK x Torx 630 TR~~
~~2 Wall Bumper 1270CVPV 626 TR~~

~~Operation: When active pressing the wall switch initiates the low power operators which signal the~~
~~Exit devices to unlatch opening both doors. Egress is always free from the inside. Key switch disables or enables the hall wall switch for security.~~

SET #2~~36~~ (door opening B30)

8	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Flush Bolt	3917-18	626	TR
1	Flush Bolt	3917-12	626	TR
1	Dustproof Strike	3911	630	TR
1	Store Room Lockset	45H-7D3J PATD	630	BE
1	Door Closer	QDC112 SN x Torx screws	689	SH
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626~~	~~TR~~
1	Overhead Stop	1020 Series x Torx	US32D	AB
1	Armor Plate	KO050 42” x 2” LDW B4E CSK x Torx	630	TR
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~27~~ 24 (door opening B00A, B01A)

4	Hinges	FBB191 ~~4 1/2~~5 X 4 1/2 NRP TORX SCREWS	US32D	ST
~~1~~	~~Passage Set~~	~~45H-0N3J~~	~~630~~	~~BE~~
1	Exit Device	2103 x 4903C	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
		~~Add Exit Device~~		
1	Door Closer	QDC111 SN x Torx screws	689	SH
~~1~~	~~Mop Plate~~	~~KO050 10" x 1" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
1	Kick Plate	KO050 ~~10” x 2”~~ 8” x 2” LDW B4E CSK x Torx	630	TR
1	Wall Bumper	1270CVPV	626	TR
1	Threshold (B00A only)	325HD x Torx screws	AL	NA

~~3~~	~~Door Silencers~~		~~1229A~~	
~~BLACK~~	~~TR~~			
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~28~~ 25 (door opening B05, B08, B09, B27, 104, 105, 151, 207, 209, 230, 231, 244)

~~4~~	~~Hinges~~		~~FBB191 4 1/2 X 4 1/2~~	
~~NRP TORX SCREWS~~	~~US32D~~		~~ST~~	
4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Store Room Lockset	45H-7D3J PATD	630	BE
1	Door Closer/st~~/st~~op	QDC119 SN x Torx screws	689	SH
1	Wall Bumper	1270CVPV	626	TR
1	Armor Plate (@ door 104)	KO050 42” x 2” LDW B4E CSK x Torx	630	TR
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~28A~~ 26 (door opening B03, B04, B06, 208)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Store Room Lockset	45H-7D3J PATD	630	BE
1	Door Closer~~/stop~~	~~QDC119~~ QDC115 SN x Torx screws	689	SH
1	Overhead Stop	1020 Series x Torx	US32D	AB
1	Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~29~~ 27 (door opening B18A, B20, B26, B29, B29A, B30A)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
~~1~~	~~Hospital Latch~~	~~45H-7R3J PATD x 6710 ABH~~	~~630~~	~~BE~~
1	Passage Set	45H-0N3J	630	BE
1	Door Closer/ Hold Open	QDC112 SN x Torx screws	689	SH
1	Armor Plate	KO050 42" x 2" LDW B4E CSK x Torx	630	TR
1	Wall Bumper	1270CVPV	626	TR
3	Door Silencers	1229A	BLACK	TR

~~SET #30~~

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Store Room Lockset~~	~~45H-7D3J PATD~~	~~630~~	~~BE~~
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

SET #~~31~~ 28 (door opening 163)

4	Hinges	FBB199 ~~4 1/2~~5 X 4 1/2 NRP TORX SCREWS		US32D ST
1	Store Room Lockset	45H-7D3J PATD	630	BE
1	Door Closer / Holder	QDC112 SN x Torx screws	689	SH
1	Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx		630 TR
1	Overhead Stop	1020 Series x Torx	US32D	AB
1	Safety Tread	3504 x Torx screws	AL	NA
~~1~~	~~Saddle Threshold~~	~~513 x Torx screws~~	~~AL~~	~~NA~~
1	Gasketing (Head & Jambs)	103 NA FATT Torx Screws		NA
1	Auto Door Bottom	420 NA Torx Screws		NA

SET #~~32~~ 29 (door opening 229)

4	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
~~1~~	~~Classroom Lockset~~	~~45H-7R3J PATD~~	~~630~~	~~BE~~
1	Store Room Lockset	45H-7D3J PATD	630	BE
1	Door Closer	QDC115 SN x Torx screws	689	SH
1	Wall mount Dr. Stop & Holder	1260	626	TR
~~3~~	~~Door Silencers~~	~~1229A~~		
~~BLACK~~	~~TR~~			

1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

~~SET #33~~

~~2~~	~~Continuous Hinge~~	~~SL57HD W/TIPIT ANTI LIG x Security screws~~	~~CL~~	~~SP~~
~~2~~	~~Dummy Bar~~	~~N673DR~~	~~630~~	~~PR~~
~~2~~	~~Exit Device Trim~~	~~2902A~~	~~630~~	~~PR~~
~~2~~	~~Door Closer~~	~~QDC111 x 8Q00470 TJ mount x Torx screws~~	~~689~~	~~SH~~
~~2~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~2~~	~~Overhead Stop~~	~~1020 Series x Torx~~	~~US32D~~	~~AB~~

~~Gaskets and Seals are by door manufacturer.~~

~~SET #34~~

~~1~~	~~Continuous Hinge~~	~~SL57HD W/TIPIT ANTI LIG x Sec screw~~	~~CL~~	~~SP~~
~~1~~	~~Deadlatch~~	~~4510 x 4560~~	~~628~~	~~AR~~
~~2~~	~~Cylinder~~	~~1E-74 PATD~~	~~626~~	~~BE~~
~~1~~	~~Door Closer~~	~~QDC112 x 8Q00470 TJ mount x Torx screws~~	~~689~~	~~SH~~
~~1~~	~~Push pull bar~~	~~1737~~	~~630~~	~~TR~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~1~~	~~Overhead Stop~~	~~1020 Series x Torx~~	~~US32D~~	~~AB~~

~~Gaskets and Seals are by door manufacturer.~~

~~SET #35~~

~~4~~	~~Hinges~~	~~FBB199 5 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Passage Set~~	~~45H-0N3J~~	~~630~~	~~BE~~
~~1~~	~~Door Closer~~	~~QDC111 SN x Torx screws~~	~~689~~	~~SH~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~1~~	~~Wall Bumper~~	~~1270CVPV~~	~~626~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

~~SET #36~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Classroom Lockset~~	~~45H-7R3J PATD~~	~~630~~	~~BE~~
~~1~~	~~Kick Plate~~	~~KO050 10" x 2" LDW B4E CSK x Torx~~	~~630~~	~~TR~~
~~3~~	~~Door Silencers~~	~~1229A~~	~~BLACK~~	~~TR~~

~~SET #37~~

~~4~~	~~Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
~~1~~	~~Exit Device~~	~~2103 x 1703A~~	~~630~~	~~PR~~

~~1 Rim Cylinder 12E-72 PATD 626 BE~~
~~1 Door Closer QDC115 SN x Torx screws 689 SH~~
~~1 Kick Plate KO050 10" x 2" LDW B4E CSK x Torx 630 TR~~
~~1 Wall Bumper 1270CVPV 626 TR~~
~~3 Door Silencers 1229A BLACK TR~~

SET #~~38~~ 30 (door opening B19, 126, 129, 148, 149, 203, 226, 227)

~~4 Hinges~~	~~FBB191 4 1/2 X 4 1/2 NRP TORX SCREWS~~	~~US32D~~	~~ST~~
4 Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1 Privacy	45H-0L3JVIN	630	BE
1 Door Closer	QDC111SN x Torx screws	689	SH
1 Kick Plate	KO050 ~~10" x 2"~~ 8" x 2" LDW B4E CSK x Torx		630 TR
1 Wall Bumper	1270CVPV	626	TR
~~3 Door Silencers~~	~~1229A BLACK TR~~		
1 Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~39~~ 31 (door opening 147)

8	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Exit Device	2303 x 4903C	630	PR
1	Rim Cylinder	12E-72 PATD	626	BE
		~~Add Exit Device~~		
1	Flush Bolt	3917-18	626	TR
1	Flush Bolt	3917-12	626	TR
1	Dustproof Strike	3911	630	TR
~~1~~		~~Classroom Lockset~~	~~45H-7R3J~~	~~PATD~~
~~630~~		~~BE~~		
		~~Change to Storeroom Lockset~~		
1	Door Closer	QDC112 SN x Torx screws	689	SH
1	Wall Bumper	1270CVPV	626	TR
1	Armor Plate	KO050 42” x 2” LDW B4E CSK x Torx	630	TR
1	Smoke Gasket	5050B (Head & Jambs)	BLACK	TR

SET #~~40~~ 32 (door opening B21, 127, 150)

~~8~~		~~Hinges~~	~~FBB191 4 1/2 X 4~~	
~~1/2 NRP TORX SCREWS~~		~~US32D~~	~~ST~~	
8	Hinges	FBB199 5 X 4 1/2 NRP TORX SCREWS	US32D	ST
1	Flush Bolt	3917-18	626	TR
1	Flush Bolt	3917-12	626	TR
1	Dustproof Strike	3911	630	TR
1	Store Room Lockset	45H-7D3J PATD	630	BE
2	Overhead Stop	1020 Series x Torx	US32D	AB
2	Door Silencers	1229A	BLACK	TR

SET #33 (door opening 212A)

1	Bypass track set	BPC250N		ST
2	Recessed Pull	1060	US26D	TR

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Window units.
2. Vision lites.
3. Entrances and other doors.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 08 Section “Hollow Metal Doors and Frames."
2. Division 08 Section “Flush Wood Doors."
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts".
4. Division 08 Section “Glazed Aluminum Curtainwalls.”
5. Division 08 Section “Aluminum Windows.”
6. Division 08 Section “Sectional Overhead Doors” for glazing in vision lites at service doors.
7. Division 08 Section “Glazing Surface Films” for security and graphic films applied to glazing assemblies.

1.3 DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer’s directions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer’s directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.

D. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film

on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

1. Glass Thicknesses: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
   b. Basic Wind Speed: Per Structural Drawings.
   c. Exposure Category: Per Structural Drawings.

2. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
3. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm (0.23 inch).
4. Minimum glass thickness, nominally, of lites in interior walls is 6.0 mm (0.23 inch).

   a. Glass thicknesses at interior lites shall be sufficient to prevent glass deflection that exceeds 0.25 inches.

5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product data for each glass product and glazing material indicated.

B. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

C. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

D. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

E. Maintenance data for glass and other glazing materials to include in Operating and Maintenance Manual specified in Division 01.

F. Samples of each type of glazing proposed on the project. Provide 2 (each) 12" by 12" square samples of each glazing assembly.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."
2. AAMA Publications: AAMA TIR-A7 "Sloped Glazing Guidelines" and "Glass Design for Sloped Glazing."
3. LSGA Publications: "LSGA Design Guide."
4. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

3. Location of Safety Glazing: Refer to IBC, 2012 Edition Section 2406.3, Hazardous Locations.

C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:

1. Insulating Glass Certification Council (IGCC).
2. Associated Laboratories, Inc. (ALI).
3. National Certified Testing Laboratories (NCTL).

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:

1. Primary glass of each (ASTM C 1036) type and class indicated.
2. Heat-treated glass of each (ASTM C 1048) condition indicated.
3. Laminated glass of each (ASTM C 1172) kind indicated.
4. Insulating glass of each construction indicated.

F. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer’s directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator’s recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4.4 deg C).

1.9 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty on Coated Glass Products: Submit written warranty signed by coated glass manufacturer agreeing to finish replacements for those coated glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

C. Manufacturer's Warranty on Laminated Glass: Submit written warranty signed by insulating glass manufacturer agreeing to furnish replacements for those laminated glass units that deteriorate as defined in the "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

D. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and if applicable, form, finish, mesh and pattern.

B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and if applicable, form, finish, and pattern.

C. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

E. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

F. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for wind loads as indicated on drawings when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
2. Small-Missile Test: For glazing located more than 30 feet (9.1 m) above grade.

G. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 FLAT GLASS MATERIALS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

C. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

D. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

1. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is required by the IBC.

2.3 LAMINATED GLASS

A. Laminated Glass: Comply with ASTMC 1172 for kinds of laminated glass indicated and other requirements specified.

B. Interlayer: Interlayer material is indicated below, clear or frosted, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

C. Interlayer Material: Polyvinyl butyral sheets or cured resin, white diffused laminate on interior surfaces. At exterior laminated glass provide urethane water resistant type laminate.

D. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

2.4 HEAT-TREATED FLOAT GLASS PRODUCTS, GENERAL

A. Fabrication Process: By horizontal (roller-hearth) free of tong marks. Provide in constituent glass sheets in making up laminated glass.

2.5 INSULATING GLASS PRODUCTS

A. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated. Provide at all exterior openings subject to building heat loss or gain. All glazing lites shall be heat strengthened if required by insulated glass unit manufacturer or to resist thermal forces for configurations specified.

1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
2. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites 6.0 mm (0.23 inch) thick and nominal 1/2-inch dehydrated space between lites, unless otherwise indicated.
3. Performance Classification per ASTM E 774: Class A.
4. Outdoor Lite: Laminated on first surface at any openings within 10'-0" of adjacent grade or interior floor level, tempered elsewhere.
5. Sealing System: Manufacturer's standard.
6. Spacer Material: Manufacturer's standard metal.
7. Desiccant: Manufacturer's standard.
8. Corner Construction: Manufacturer's standard corner construction.

B. Low-E Insulating-Glass Units:

1. Basis-of-Design Product: “Solarban 72 Starphire” by PPG Industries or a comparable product by one of the following:

    a. AFG Industries Inc.
    b. Viracon.
    c. Pilkington Building Products North America.
    d. Guardian

2. Overall Unit Thickness and Thickness of Each Lite: 1 inch overall unit thickness with glass lite thickness of 1/4 inch and 1/2 inch airspace.
3. Outdoor Lite: Laminated on first surface at any openings within 10’-0” of adjacent grade, tempered elsewhere.
4. Indoor Lite: Tempered.
5. Visible Light Transmittance: 71 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.30 maximum.
9. Outdoor Visible Reflectance: 13 percent + or – 5%.
10. Low-E Coating: Second surface.
11. Silk Screen Ceramic Frit: Provide GlasPro-HDDP silk screen ceramic frit:

    a. Locations: On Surface No. 2 at locations indicated on Drawings.
    b. Graphic Image: Custom to be provided by Architect.

2.6 ELASTOMERIC GLAZING SEALANTS

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer’s standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements, including those referencing ASTM classifications for Type, Grade, Class and Uses.

1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Glazing Sealant Product Data Sheet, provide products, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, with the capability to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTN C 920 for uses indicated.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following companies.

1. Preformed Gaskets:

a. Advanced Elastomer Systems, L.P.
b. Schnee-Morehead, Inc.
c. Tremco, Inc.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

2.10 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
2. Remove damaged glass from Project site and legally dispose of off-site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:

1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each lite is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

B. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000

SECTION 089000 – LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:

1. Extent of louvers are indicated on drawings, including indications of sizes and locations.

B. Related Sections:

1. Division 07 Section “Sheet Metal Flashing and Trim” for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
2. Division 07 Section “Roof Accessories” for roof curbs.
3. Division 07 Section "Joint Sealants" for field-applied sealants.
4. Division 23 Sections for vents specified as part of those sections.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.

B. Shop Drawings: Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

1.4 QUALITY ASSURANCE

A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA Standard 500).

B. Field Measurements: Verify size, location and placement of louver units prior to fabrication.

C. Factory Assembly: Coordinate field measurements and shop drawings with manufacturer and factory assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Pre-assemble units in factory to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved:

1. Vertical Blade Louvers: Basis of Design Product: Construction Specialties, Inc. Model BLV-5709. Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved.

a. Industrial Louvers, Inc.
b. Ruskin.
c. American Warming and Ventilating.

2.2 VERTICAL BLADE LOUVERS

A. BLV-5709: Extruded aluminum frames and blades shall be one piece 6063-T6 alloy, designed to collect and drain water to the exterior at the sill. Heads, sills, jambs and mullions to be one-piece structural aluminum members with integral caulking slot and retaining beads. Mullions shall be sliding interlock type. Blades to be one-piece aluminum extrusions with front lip gutter and multiple secondary gutters designed to catch and direct water to sill. Louvers to be supplied with 4 inch high by full depth sill flashings formed from minimum 0.050 inch thick aluminum. Louvers shall have a minimum of 45.7% free area based on a 48” wide x 48” high size. Louver shall be factory assembled by the louver manufacturer.

1. Frame: 5” deep. .081” nominal wall thickness.
2. Blades: Nominal wall thickness of .081 inches.
3. Screen: 3/4” x .051 expanded, flattened aluminum bird screen in removable frame.

2.3 MATERIALS - LOUVERS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

E. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to four times the loads imposed for concrete, or six times the load imposed for

masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION, GENERAL

A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thickness' indicated, or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage, where applicable (for adjustable units, if any); strength; durability; and uniform appearance.

B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealants in joints between louvers and adjoining work.

C. Maintain equal louver blade spacing to produce uniform appearance.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide sill extensions and loose sills and head drip flashings made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.

F. Join frame members to one another and to stationary louver blades by welding, or mortise and tenon, except where indicated otherwise or where field bolted connections between frame members are made necessary by size of louvers. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

2.5 METAL FINISHES

A. General: Comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are assembled. Protect finishes on exposed surfaces with protective covering, prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process.

1. Polyvinylidene Fluoropolymer Coating; Manufacturer’s standard three-coat, thermo-cured, full-strength PVDF coating consisting of 0.8 mil thick primer and finished with 0.8 mil thick, 70% Hylar 5000 (by Ausimont), Kynar (by Atochem), or Duranar (by PPG) PVDF coating and 0.8 mil clear coat. Thickness and flat sheen of 10% at 85 degree reflective gloss when testing in accordance with ASTM D 523.
2. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of twenty (20) years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 ASTM D 424; and without fading in excess of five (5) NBS units per ASTM D 2244.
3. Color: Manufacturer’s standard Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.3 INSTALLATION

A. Locate and place louver units plumb, level and in proper alignment with adjacent work.

B. Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as indicated.

D. Repair finishes damaged by cutting, welding, soldering and grinding operations require for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations, and refinish entire unit, or provide new units, at Contractor's option.

E. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.

F. Provide concealed gaskets, flashings, joint fillers, and insulation, and install as work progresses to make installations weather tight.

G. Refer to Division 07 Sections for sealants in connection with installations of louvers

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION 089000

SECTION 092116 – GYPSUM BOARD SHAFT-WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes:

1. Gypsum board shaft wall assemblies as detailed on the Drawings.

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 09 Section “Gypsum Board Assemblies” for requirements referenced in this Section for applying and finishing gypsum board over liner panels of gypsum board shaft-wall assemblies.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this Section or other referenced standards.

1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Performance Requirements, General: Provide gypsum board shaft-wall assemblies that comply with the following requirements:

1. They are composed of proprietary gypsum board panels and metal components designed for erection from outside the shafts.
2. They comply with performance requirements specified as determined from testing manufacturers’ standard assemblies representing those indicated for this Project.

B. Fire Resistivity: Fabricate and install gypsum board shaft-wall assemblies to have fire-resistance rating of 1-hour minimum.

C. Structural Performance Characteristics: Engineer, fabricate, and install gypsum board shaft-wall assemblies to withstand the following lateral design loads (air pressures) without failing and while maintaining an airtight and smoke-tight seal. Apply design loads transiently and cyclically under in-service conditions for maximum heights of partitions indicated. Evidence of failure includes deflections exceeding those indicated

below, bending stresses causing studs to break or to distort, and end-reaction shear causing runners to bend or to shear and studs to become crippled.

1. Lateral Design Load: 10 psf.
2. Deflection Limit: 1/240 of partition height, except where otherwise indicated.

1.5 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product data from manufacturers for each type of gypsum board shaft-wall assembly specified.

C. Engineering data from gypsum board shaft-wall assembly manufacturer certifying and substantiating compliance of gypsum board shaft-wall assemblies with structural performance requirements.

D. Assembly test reports from a qualified independent testing agency certifying and substantiating compliance of gypsum board shaft-wall assemblies with structural and sound-attenuation performance requirements based on tests performed on manufacturers' standard assemblies representing those indicated.

E. Fire-test-response reports from testing and inspecting agency substantiating compliance of gypsum board shaft-wall assemblies with fire-resistivity performance.

1. Include data substantiating that elevator entrances and other items indicated as penetrating gypsum board shaft-wall assemblies do not negate fire resistance rating requirements.

F. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence each assembly's compliance with requirements and with the building code in effect for Project..

1.6 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets or letters from product manufacturers indicating that gypsum board, acoustic ceiling systems, wall base, wall covering products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate

compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products

1.7 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide gypsum board shaft-wall assemblies that comply with the following requirements:

1. Fire-resistivity tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency includes UL, Warnock Hersey, or another agency performing testing and follow-up services that is acceptable to authorities having jurisdiction.
2. Gypsum board wall assemblies indicated are identical in materials and construction to those tested for fire resistivity per ASTM E 119.
3. Fire-resistance-rated assemblies are indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual," design designations listed in the UL "Fire Resistance Directory," or by Warnock Hersey or another qualified testing and inspecting agency.

B. Single-Source Responsibility: Obtain components for gypsum board shaft-wall assemblies from a single manufacturer for each type of assembly indicated.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal trim and framing components.

1.9 PROJECT CONDITIONS

A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in the following Division 09 Section "Sypsum Board Assemblies."

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All gypsum board, acoustic ceiling systems, wall base, wall covering products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Dietrich Industries, Inc.
2. Domtar Gypsum.
3. Georgia-Pacific Corp.
4. Gold Bond Building Products Div., National Gypsum Co.
5. United States Gypsum Co.
6. SCAFCO (Addendum 2)

2.3 BASIC ASSEMBLY MATERIALS

A. General: Provide standard materials and components listed in manufacturer's published product literature for gypsum board shaft-wall assemblies of type and application indicated. Provide gypsum and other panels in maximum lengths available to eliminate or minimize end-to-end butt joints and in thicknesses required to produce assemblies complying with structural and other performance requirements.

B. Steel Framing: ASTM C 645, of profile, size, and base metal thickness required to produce assemblies complying with Part 1 "Assembly Performance Requirements" Article; with sectional properties computed to conform with AISI "Specification for the Design of Cold-Formed Steel Structural Members"; and as follows:

1. Protective Coating: Manufacturer's standard corrosion-resistant coating.

C. Gypsum Liner Panels: Proprietary liner panels as required for the specific fire-resistant-rated gypsum board shaft-wall assemblies indicated, with moisture-resistant paper facings.

D. Gypsum Sheathing: As specified in Section 09 29 00, type as required by fire-resistant assembly indicated.

E. Accessories: Corner beads, edge trim, and control joints of material and shapes specified in the Division 09 Section "Gypsum Board Assemblies" that comply with gypsum board shaft-wall assembly manufacturer's recommendation for application indicated.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board shaft-wall construction that comply with requirements indicated and recommendations of gypsum board shaft-wall assembly manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards of type indicated.

C. Steel drill screws complying with ASTM C 1002 for fastening gypsum board to steel members less than 0.03 inch thick.

D. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

E. Runner Fasteners: Provide fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of runners, fasteners, or structural substrates where anchors are embedded.

1. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with the capability to sustain, without failure, a load equal to 5 times that imposed by shaft-wall assemblies, as determined from testing per ASTM E 488 by a qualified independent testing agency..

2.5 BASIC ASSEMBLY DESCRIPTION

A. General: Characteristics of selected components are described below for purposes of indicating proprietary gypsum board shaft-wall assemblies that are manufacturer's standard. Provide complete shaft-wall assemblies that comply with requirements indicated in this Article and Part 1 "Assembly Performance Requirements" Article.

B. Cavity Shaft-Wall Assemblies: Provide assemblies constructed of proprietary gypsum liner panels inserted between steel tracks at each end of studs; with specially shaped steel studs engaged in tracks and fitted between gypsum liner panels; and with gypsum sheathing on finished side or sides applied to studs in the number of layers, thicknesses and arrangement indicated.

1. Gypsum Liner Panel Thickness: As standard with manufacturer for gypsum board shaft-wall assemblies indicated.
2. Stud Shape: C-H.
3. Stud Thickness: As standard with manufacturer for gypsum board shaft-wall assemblies indicated.
4. Stud Depth: Not less than 4 inches unless noted otherwise on Drawings.
5. Outside Finish: 1 or 2 layers 5/8-inch-thick gypsum sheathing.
6. Shaft-Side Finish: As required by manufacturer to achieve 1- or 2-hour fire rating as indicated on Drawings.
7. Cavity Insulation: As required by manufacturer to achieve 1- or 2-hour fire rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut with Installer present. Substrates include hollow metal frames, elevator hoistway door frames, cast-in anchors, and structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board shaft-wall assemblies. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Attach offset anchor plates or ceiling runners (tracks) to structure. Where offset anchor plates are required, install continuous units formed from hot-dip galvanized sheet steel of thickness indicated. Fasten plates to building structure with fasteners spaced not more than 24 inches o.c. Secure ceiling runners to offset plates with screws spaced 24 inches o.c.

3.3 INSTALLATION OF GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. General: Install gypsum board shaft-wall assemblies to comply with performance and other requirements indicated as well as with manufacturer's installation instructions and the following:

1. ASTM C 754 for installing steel framing.
2. Division 9 Section "Gypsum Drywall" for applying and finishing gypsum wallboard.
3.

B. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

1. Support elevator hoistway door frames independently of shaft-wall framing assemblies, or reinforce assemblies according to assembly manufacturer's instructions.

C. At penetrations in shaft wall, maintain fire-resistance rating of entire shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

D. Seal gypsum board shaft-walls at perimeter of each section that abuts other work and at joints and penetrations within each section. Install acoustical sealant to withstand dislocation by air pressure differential between shaft and external spaces; comply with manufacturer's instructions and ASTM C 919.

E. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2-inch- or 5/8-inch-thick gypsum board cants covering tops of projections as follows:

1. Slope cant panels not less than 75 degrees with the horizontal. Set base-edge of panels in gypsum board adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
2. Where needed to support gypsum board cants, install steel studs spaced 24 inches o.c.; extend studs from top of projection to shaft-wall framing behind cant.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to Installer that ensures gypsum board shaft-wall assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 092116

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
3. Resilient channels.
4. Penetration barrier mesh for security

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 05 Section “Cold Formed Metal Framing” for load bearing steel framing.
2. Division 06 Section “Rough Carpentry” for wood framing, blocking and furring.
3. Division 07 Section “Building Insulation” for insulation and vapor retarders installed in gypsum board assemblies.
4. Division 07 Section “Through-Penetration Firestop Systems” for firestopping systems and fire-resistance-rated joint sealants.
5. Division 09 Section “Gypsum Board Assemblies” for gypsum wallboard attached to walls and ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep dry and protected against damage from weather, surface contamination, corrosion, construction traffic, and other causes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. All non-load bearing framing members, where not otherwise indicated, shall be of gauge/thickness as determined by supplier/installer based upon design performance calculations for each applicable wall condition but, in no case, lighter than 20 gauge.

1. Provide appropriate member sizes, spacings and gauges in accordance with ICC-ES Report No. ER-4943P span tables to comply with the requirements listed below. Provide calculations stamped by a licensed professional engineer for conditions not included in span tables.
2. Maximum lateral deflection of walls shall be L/120 under a 5 PSF lateral pressure, except for walls supporting brick veneer which shall be framed in accordance with the Architectural/Structural drawings. In general, do not vary stud widths from Architectural drawings without prior approval. Install appropriate headers and jamb studs at wall openings to support wall and ceiling loads.
3. Size ceiling joists for a maximum L/480 deflection.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.018 inch.
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above of up to 1-1/2 inches.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
2) MBA Building Supplies; FlatSteel Deflection Track.
3) Steel Network Inc. (The); VertiClip SLD Series.
4) Superior Metal Trim; Superior Flex Track System (SFT).
5) Telling Industries; Vertical Slip Track.
6) SCAFCO (Addendum 2)

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
b. Grace Construction Products; FlameSafe FlowTrak System.
c. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Product: Provide Clark Dietrich "RC Deluxe Single-Leg Resilient Channel", *SCAFCO Serenity Resilient Channel (Addendum 2)* or approved equal.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

J. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 1-1/4 inches, minimum uncoated-metal thickness of 0.018 inch, and depth as indicated on Drawings.

K. Penetration barrier Mesh for Security: High strength expanded metal mesh attached directly to steel framing beneath gypsum wall panels with mesh manufacturer's standard clips.

1. Material: Type II, Class 1 carbon steel mesh complying to ASTM F1267.
2. Configuration: 16 gauge (0.048" thick), One inch diamond pattern, 38 lbs per 100 SF, 80 percent open area.
3. Basis of Design Product: Clark Dietrich BM-10-16F.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inchand minimum 1/2-inch wide flanges.

1. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.018 inch.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.018 inch.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt or foam gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c. or as indicated on Drawings.

F. Z-Furring Members:

1. Erect insulation as detailed and hold in place with Z-furring members spaced 24 inches o.c. unless otherwise indicated.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Barrier Mesh:

1. Barrier Mesh sheets may be installed with diamond running in direction most suitable.
2. Install with manufacturer’s clips to secure mesh to the framing members. Mesh joints shall begin, join, and terminate on a framing member. Joints may join staggered or butt together.
3. Barrier mesh sheets not joining at a framing member shall be wire tied with 18 gauge steel tie wire. Wire tying shall be no less frequent than the installation of mesh clips.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes:

1. Interior gypsum board.
2. Exterior gypsum soffit board.
3. Closures at intersection of partition walls and interior storefront glazing.

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 05 Section “Cold Formed Metal Framing” for load bearing steel framing.
3. Division 06 Section “Rough Carpentry” for wood blocking and furring.
4. Division 06 Section “Sheathing” for exterior sheathing applied over metal framing.
5. Division 07 Section “Building Insulation” for insulation and vapor retarders installed in gypsum board assemblies.
6. Division 07 Section “Through-Penetration Firestop Systems” for firestopping systems and fire-resistance-rated joint sealants.
7. Division 07 Section “Non-Structural Metal Framing” for non-load bearing steel framing.
8. Division 09 Section “Ceramic Tile” for tile backer board.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets or letters from product manufacturers indicating that gypsum board, acoustic ceiling systems, wall base, wall covering products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products

1.5 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.6 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All gypsum board, acoustic ceiling systems, wall base, wall covering products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved:

a. CertainTeed
b. G-P Gypsum.
c. National Gypsum Company
d. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch unless noted otherwise.
2. Long Edges: Tapered.

C. Water-Resistant Backing Board: Gypsum product meeting ASTM C 630, and ASTM D3273 for resisting the growth of mold and mildew. Moisture resistant core with inorganic coated glass fiber mats imbedded into face and back. Tapered edges and of type and thickness indicated below and in maximum lengths available to minimize end-to-end butt joints.

1. Location: All backing for plastic laminate and FRP.
2. Core: 5/8 inch Type X unless noted otherwise.
3. Long Edges: Tapered.
4. Size: 4 feet by 8 feet minimum.
5. Products: Subject to compliance with requirements, provide one of the following products or approved:

a. “Densarmor Plus,” Georgia-Pacific Gypsum.

D. Abuse-Resistant Gypsum Board: ASTM C 1629, Level 2

1. Core: 5/8 inch Type X unless noted otherwise.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
4. Manufactured to produce greater surface abrasion (ASTM D 4977), surface indentation (ASTM D 5420), soft-body impact (ASTM E 695) than regular-type Type X gypsum board.
5. Products: Subject to compliance with requirements, provide one of the following or approved:

a. Fiberock Brand VHI (Very High Impact Abuse Resistance) by United States Gypsum Company.

2.4 EXTERIOR GYPSUM SOFFIT BOARD

A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or as approved:

a. CertainTeed
b. G-P Gypsum
c. National Gypsum Company
d. USG Corporation

2. Core: ½ inch , regular type, tapered, Type X.

2.5 CLOSURES AT INTERSECTION OF PARTITIONS AND STOREFRONT WINDOWS

A. Adjustable closures at storefront mullions: Pre-assembled, spring loaded, insulated and gasketed closures matching profile size of storefront mullion.

1. Material: Aluminum with powder coat finish to match storefront mullion color.
2. Acoustical performance: STC 38.
3. Quality Standard Product: Gordon Mullion Mate adjustable partition closure.

B. Closures at storefront glazing: Class A rated closure with fire-resistant foam core within silicon coating.

1. Quality Standard Product: Emseal Quiet Joint®

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Formed metal faced with paper tape. Sheet steel zinc-coated by hot-dip process. Fed. Spec. QQ-S-775-d, Type 1, Class E.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (control) joint. Formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable cap.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper reinforcing tape.
2. Backer Board, Gypsum (Coated Glass Mat): Fiberglass joint tape. 10” x 10”.

C. Joint Compound:

1. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.

a. Ready Mix Formulation: Factory-premixed product.
b. Taping compound formulated for embedding tape and for first coat over fasteners and flanges of corner beads and edge trim.
c. Topping compound formulated for fill (second) and finish (third) coats.

2. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

a. For filling joints and treating fasteners of water-resistant gypsum backing board for ceramic tile, use formulation recommended by gypsum board manufacturer.

3. Joint Compound for Tile Backing Panels (DensArmor Plus): Fiberglass mesh tape, bedded with gypsum setting-type joint compound. Following coats may be regular joint compound.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

D. Thermal Insulation: As specified in Division 07 Section "Building Insulation."

E. Vapor Retarder: As specified in Division 07 Section "Building Insulation."

F. Primer-Surfacer (Tuff-Hide):

1. Manufacturer: USG Sheetrock Brand Tuff-Hide is ready mixed, 60% solids, latex skim coat and primer, formulated for a one coat 9.8-13 mils DFT application.

2. Location: As noted on the drawings.

2.9 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.10 VOC LIMIT

A. Refer to VOC limit tables in Section 018119 for VOC limits for products in this section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. All gypsum board shall be held 3/8 inch minimum above finish floor. Install closed cell backer rod and sealant in joint.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. On all walls and ceilings as indicated on the drawings and noted on the room finish schedule.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install showers, where indicated. Install with 1/4 inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Gypsum Board Finish Levels: Provide the following levels of gypsum board finish per Northwest Wall and Ceiling Bureau, Seattle, WA (1-206-524-4243):

1. Level 1: (Fire-taping for plenum areas above ceilings, in attics, in areas where the assembly would generally be concealed): All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tape and fastener heads need not be covered with joint compound. Tool marks and ridges are acceptable.
2. Level 2: (For ceramic tile, acoustic tile, and plastic laminate wainscot backing board): All joints, interior angles, and accessories, shall have tape embedded in joint compound. Wipe off the excess leaving a thin coat of joint compound over the tape of all joints, angles, and accessories. Cover fastener heads with one coat

of joint compound and wipe off the excess. Surface shall be fee of excess joint compound. Tool marks and ridges are acceptable.

a. Use the following joint compound combination as applicable to the finish levels specified:

1) Embedding and First Coat: Light weight setting compound.

3. Level 4: (For all other surfaces): All joints and interior angels shall have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. All joint compound shall be smooth and free of tool marks and ridges.

D. Use the following joint compound combination as applicable to the finish levels specified:

1. Embedding and First Coat: Ready-mixed, drying-type, taping compound.
2. Fill (Second) Coat: Ready-mixed, drying-type, topping compound.
3. Finish (Third) Coat: Ready-mixed, drying-type, topping compound.

E. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.7 INSTALLING PARTITION CLOSURES AT STOREFRONT WINDOWS

A. Install closures after partitions and storefront are in place. Follow manufacturer's instructions to assure tight fit and acoustical performance.

B. Clean closures and adjacent glass after installation.

3.8 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying Architect, complete the following in areas to receive gypsum board ceilings:

a. Installation of 80 percent of lighting fixtures, powered for operation.
b. Installation, insulation, and leak and pressure testing of water piping systems.
c. Installation of air duct systems.

d. Installation of air devices.
e. Installation of mechanical system control air tubing.
f. Installation of ceiling support framing.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 – CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ceramic wall tile.
2. Porcelain wall tile.
3. Tile backer board.
4. Metal edge strips installed as part of tile installations.

B. Related Sections include the following:

1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Division 09 Section "Gypsum Board Assemblies" for moisture resistant gypsum board.

1.3 DEFINITIONS

A. Module Size: Actual tile size plus joint width indicated.

B. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with the recommendations of ANSI A108 and A118, and the installation practices published in the Tile Council of North America (TCA) Handbook for Ceramic, Glass and Stone Tile Installation, most recent edition.

B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6 static COF.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Material Test Reports: For each tile-setting and -grouting product.

F. Provide maintenance information for the cleaning and maintenance of the grout and ceramic tile for inclusion in Operations & Maintenance Data Manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Waterproofing.
2. Joint sealants.
3. Tile backer units.

D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of each type of floor tile installation.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
3. Build mockup of each type of wall tile installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1. Installation Standards.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.2.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. See “Finish Key” on Finish Schedule Drawing.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 TILE PRODUCTS

A. Glazed Ceramic Wall Tile (CT-3.1, CT-3.2 and CT-3.3):

1. Basis of Design Product: Daltile "Modern Dimensions."
2. Size, Finish, Color: As indicated on the Room Finish Schedule.
3. Thickness: 1/4 inch.
4. Edges: Manufacturer's standard square with bullnose edges.

B. Porcelain Tile (CT-3.4):

1. Basis of Design Product: Daltile "Exhibition Colorbody Porcelain Tile."
2. Size, Finish, Color: As indicated on the Room Finish Schedule.
3. Thickness: 3/8 inch.
4. Base and Corner Trim: As indicated on the Room Finish Schedule.

C. Glazed Ceramic (CT-3.5):

1. Basis of Design Product: Daltile "Modern Dimensions, Wave Wall Tile."
2. Size, Finish, Color: As indicated on the Room Finish Schedule.
3. Thickness: 5/16 inch.
4. Edges: Manufacturer's standard square with bullnose edges.

2.3 SETTING AND GROUTING MATERIALS

A. Manufacturers:

1. Atlas Minerals & Chemicals, Inc.
2. Boiardi Products Corporation.
3. Bonsal, W. R., Company.
4. Bostik.
5. C-Cure.
6. Custom Building Products.
7. DAP, Inc.
8. Jamo Inc.
9. LATICRETE International Inc.
10. MAPEI Corporation.
11. Southern Grouts & Mortars, Inc.
12. Summitville Tiles, Inc.
13. TEC Specialty Products Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.

a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

C. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.

1. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

    a. Unsanded grout mixture for joints 1/8 inch and narrower.
    b. Sanded grout mixture for joints 1/8 inch and wider.

2.4 TILE BACKER BOARD

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178 with manufacturer's standard edges.

1. Tile backing for all locations except in shower rooms.
2. Products: Subject to compliance with requirements, provide the following:

    a. CertainTeed Corp.; GlasRoc Tile Backer.
    b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

3. Core: 5/8 inch, Type X.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Joint Compound for Tile Backer Board: As recommended by backing panel manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer’s standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Edge Protection Strip: Provide strip Model “SCHIENE” as manufactured by Schluter Systems, or approved. Stainless Steel with a trapezoid-perforated anchoring leg connected to an 87 degree angled vertical section with a 1/8" wide sloped top flange. Height of unit to flush to 1/32" below top of tile.

1. Installation: Shall be installed according to manufacturer’s specifications at edge of tile and at outside corners.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

1. Products:

a. Bonsal, W. R., Company; Grout Sealer.
b. Bostik; CeramaSeal Grout Sealer.
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Grout and Tile Sealer.
e. Jamo Inc.; Penetrating Sealer.
f. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.

2.6 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (latex-portland cement grouts), comply with ANSI A108.10.

H. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer’s written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

I. At showers, install tile backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel:

1. Comply with ASTM C 840.

2. Butt backer boards panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
3. All backer boards shall be held 3/8 inch minimum above finish floor. Install closed cell backer rod and sealant in joint.
4. Locate edge and end joints over supports,. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
5. Form control and expansion joints with space between edges of adjoining gypsum panels.
6. Cover both faces of support framing with backer panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

    a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
    b. Fit gypsum panels around ducts, pipes, and conduits.
    c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

7. Isolate perimeter of backer board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
8. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 FINISHING COATED GLASS MAT BACKER BOARD (EXPOSED AREA ABOVE WAINSCOT)

A. General: Treat backer board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare backer board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, and beveled edges, and damaged surface areas.

C. Apply joint tape over backer board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 FINISHING COATED GLASS MAT BACKER BOARD (NON-EXPOSED WALL SURFACE AREA BEHIND WAINSCOT

A. At beveled joints install fiberglass tape and trowel in with thin-set flush with backer board. After it sets sand lightly.

3.7 WATERPROOFING INSTALLATION (AT SHOWER AREAS)

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.8 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series tile installation standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Glazed Wall Tile: 1/16 inch.

3.9 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile areas. Protect installed tile work during construction period to prevent staining, damage, and wear.

C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093013

dj/July 18, 2017

SECTION 095113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Acoustic lay-in panels.
2. Suspended grid system.
3. Suspended grid system, acoustic cloud.
4. Suspension systems, moldings and trim.

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance Coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved: The General Contractor shall be responsible for the generation of a single set of scaled reflected ceiling plans in which all of the suppliers and installers of overhead materials, i.e. ceiling grid, lights, sprinklers, smoke detectors, grilles, ducts, etc., can meet and coordinate their individual requirements for space and installation needs. The General Contractor shall also be responsible for the scheduling of such coordination meetings.

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-long Samples of each type, finish, and color.
3. Metal Slats with Wood Veneer: Set of 18-inch-long samples.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets or letters from product manufacturers indicating that gypsum board, acoustic ceiling systems, wall base, wall covering products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings, including section of linear metal ceiling with wood veneer.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.9 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 5 percent of quantity installed.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All gypsum board, acoustic ceiling systems, wall base, wall covering products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 75 or less.

2.3 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Acoustical Panel Standard: Comply with ASTM E 1264.

F. Glass-Fiber Acoustical Insulation: Provide 2-inch un-faced fiberglass insulation batts on top of linear metal ceiling system. Install batts in manner that conceals batts from visual exposure.

2.4 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Ceiling Panel C-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries “Cortega (No. 747)” or a comparable product by one of the following or approved:

a. CertainTeed Corporation.
b. Chicago Metallic Corporation.
c. USG Interiors, Inc.; Subsidiary of USG Corporation.

2. Classification: Fiberglass rectangular lay-in panel for 15/16-inch grid.
3. Color: White.
4. LR: Not less than 0.82.
5. NRC: Not less than 0.55.
6. CAC: 40.
7. Size: 24 inches by 48 inches by 5/8 inch thick.

B. Ceiling Panel C-2:

1. Basis of Design: Subject to compliance with requirements, provide Armstrong World Industries “Ultima Health Zone High NRC (No. 1448)” or a comparable product by one if the following or approved:

   a. CertainTeed Corporation.
   b. Chicago Metallic Corporation.
   c. USG Interiors, Inc.; Subsidiary of USG Corporation.

2. Classification: Mineral fiber square lay-in panel with square edge for 15/16-inch exposed grid.
3. Color: White
4. LR: Not less than 0.86.
5. NRC: Not less than 0.80
6. CAC: 35
7. Mold/Mildew Inhibitor: Bioblock, ASTM D 3273.
8. Size: 24 inches by 48 inches by 1 inch thick.

C. Ceiling Panel C-3:

1. Basis of Design: Subject to compliance with requirements, provide Armstrong World Industries “Armstrong Cirrus Second Look III (No. 514)” or a comparable product by one if the following or approved:

   a. CertainTeed Corporation.
   b. Chicago Metallic Corporation.
   c. USG Interiors, Inc.; Subsidiary of USG Corporation.

2. Classification: Mineral fiber square lay-in panel with beveled tegular edge for 15/16-inch exposed grid.
3. Color: White
4. LR: Not less than 0.85.
5. NRC: Not less than 0.65
6. CAC: 35
7. Mold/Mildew Inhibitor: Bioblock, ASTM D 3273.
8. Size: 24 inches by 48 inches by 3/4 inch thick.

2.5 METAL SUSPENSION GRID SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. At the Elementary School Stage, Room E203, and at other locations indicated on the Drawings, provide “Tech Black” factory painted grid.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
3. Painted Wire: At Panel C-2a locations paint wires black.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.6 METAL SUSPENSION GRID SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Basis of Design Product: The design for the Acoustic Ceiling Grid System is based on Armstrong World Industries, Inc. “Prelude XL.” Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

a. CertainTeed Corporation.
b. Chicago Metallic Corporation.
c. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. (Typical Grid unless noted otherwise) Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: White

C. Seismic Clips: Provide Armstrong, or approved, seismic clip "BERC2" at point of connection between grid system and perimeter ceiling edge molding.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following or approved:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide Armstrong World industries, Inc. "Flex Molding No. 7890" and "Shadow Molding No. 7871" at locations that abut a vertical surface.
2. Provide Armstrong World industries, Inc. "Axiom AX4STR" trim channel and "Axiom "AX4QSOS" pre-mitered corners at all lay-in acoustical grid clouds or where ceiling grid does not abut a vertical surface.

2.8 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following or approved:

1. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panels and suspension system, including necessary hangers, grillage, splines, and other supporting hardware, in accordance with ASTM C 636, 2003 IBC, CISCA's "Ceiling Systems Handbook," (UL Design) and any applicable code requirements.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:

1. Suspended ceiling system.
2. Hangers, anchors and fasteners.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096229 - CORK FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cork floor tile.

B. Related Sections include the following:

1. Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete slab testing procedures.
2. Division 03 Section “Cementitious Floor Underlayment’ for concrete floor patching and leveling.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each type, color, pattern, and finish of cork flooring required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cork Flooring: Furnish one box for every 50 boxes or fraction thereof, of each type, color, pattern, and finish of cork flooring installed.

1.6 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets or letters from product manufacturers indicating that flooring products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store cork flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store cork flooring on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 60 deg F or more than 85 deg F where relative humidity is between 50 and 70 percent, in spaces to receive cork flooring during the following time periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 60 deg F or more than 85 deg F.

C. Close spaces to traffic during cork flooring installation.

D. Close spaces to traffic for 72 hours after cork flooring installation.

E. Install cork flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All resilient flooring, laminate flooring, engineered and/or prefinished wood flooring, tile flooring with factory-applied organic coatings/sealants products used at the project shall comply with the requirements of the California Department of Health Services Standard

Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For cork flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class II.

2.3 CORK FLOOR TILE

A. Composition: 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.

1. Quality Standard Product: Duro Design glue down cork tile.

B. Nominal Density: 30 lb/cu. ft. (500 kg/cu. m), minimum.

C. Nominal Thickness: 5/16 inch.

D. Nominal Size: 12 by 24 inches.

E. Factory Finish: Stained and sealed.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: 100 % portland cement-based formulation provided or approved by cork flooring manufacturer for applications indicated.

B. Adhesive: Water-resistant products as recommended by flooring and adhesive manufacturers to suit cork flooring and substrate conditions indicated.

2.5 FIELD-APPLIED FINISHES

A. Finish Coatings: Four finishing urethane coats as recommended by cork flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of cork flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by cork flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Perform tests recommended by cork flooring manufacturer, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install cork flooring until materials are same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move cork flooring products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing cork flooring.

B. Mix together floor tiles from each carton to ensure uniform distribution of shade.

C. Discard broken, cracked, chipped, or deformed floor tiles.

D. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

E. Lay floor tiles square with room axis.

F. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

G. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

H. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

I. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 FIELD-APPLIED FINISHES

A. First sweep and then vacuum the unvarnished cork floor.

B. Mix and handle varnish according to manufacturer’s instructions.

C. Apply finishes according to cork flooring manufacturer's written instructions. Allow to dry a minimum of 2 hours between coats.

D. Finish Coatings: Apply four coats, switching directions during each coat. Lightly manually scuff between the second and third coats using #180-220 grit sanding paper.

E. Allow to dry overnight before walking on the surface. Do not use drop cloths on the flooring until varnish is entirely dry.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.

B. Perform the following operations after completing cork flooring installation and final coat of varnish is dry:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect cork flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover cork flooring until Substantial Completion.

END OF SECTION 096229

dj: November 11, 2017

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall base.
2. Resilient molding accessories.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 09 Section "Resilient Sheet Flooring" for resilient sheet floor covering.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated for color comparison.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets or letters from product manufacturers indicating that flooring products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All resilient flooring, laminate flooring, engineered and/or prefinished wood flooring, tile flooring with factory-applied organic coatings/sealants products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles, or approved.

2.3 RESILIENT WALL BASE

A. Basis of Design Product: Resilient wall base is based on “Johnsonite, Traditional Perceptions.” Subject to compliance with requirements, and the Architect's color approval (10 days minimum prior to bid) shall determine the final acceptance of a comparable product by one of the following or approved:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products.
3. Endura Rubber Flooring; Division of Burke Industries, Inc.
4. Flexco (USA), Inc.
5. Mondo Rubber International, Inc.
6. Nora Rubber Flooring; Freudenberg Building Systems, Inc.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Premolded.

G. Inside Corners: Field made.

H. Finish: Matte.

I. Finish and Patterns: As indicated on Drawings.

2.4 RESILIENT MOLDING ACCESSORY

A. Basis of Design Product: The design for resilient molding accessories is based on "Johnsonite Resilient Transitions." Subject to compliance with requirements, and the Architect's color approval (10 days minimum prior to bid) shall determine the final acceptance of a comparable product by one of the following or approved:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products.
3. Marley Flexco (USA), Inc.

B. Accessories shall include but not be limited to the following:

1. Linoleum/Sheet Vinyl to Concrete: Transition between linoleum or sheet vinyl to concrete to be Johnsonite SSR-XX-B.
2. All transition strips to match the color of the base in that room.

C. Material: Rubber.

D. Colors and Patterns: As indicated on Drawings.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch wall base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

a. Do not wash surfaces until after time period recommended by manufacturer.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Use protection methods recommended in writing by manufacturer.

END OF SECTION 096513

SECTION 096516 – RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Resilient sheet floor coverings.
2. Slip-resistant safety flooring.

B. Related Sections include the following:

1. Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete slab testing procedures.
2. Division 03 Section “Cementitious Floor Underlayment’ for concrete floor patching and leveling.
3. Division 09 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with sheet floor coverings.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of floor covering required.

C. Heat-Welded Seam Samples: For each flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

D. Maintenance Data: For floor coverings to include in maintenance manuals.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

F. Cut sheets or letters from product manufacturers indicating that flooring products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project that are competent in heat-welding techniques required by manufacturer for floor covering installation.

1. Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.7 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C) >.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All resilient flooring, laminate flooring, engineered and/or prefinished wood flooring, tile flooring with factory-applied organic coatings/sealants products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 RESILIENT SHEET FLOOR COVERING

A. Basis of Design Product: Resilient sheet floor covering is based on Forbo “Marmoleum Linoleum Sheet Resilient Floor Covering.” Subject to compliance with requirements, provide the named product or the following comparable product as approved.

1. Armstrong “LinoArt Linoleum Sheet.”

a. Colors and Patterns: See Finish Schedule on Drawings.

B. Resilient Sheet Floor Covering With Backing: ASTM F 1913, Class 1, Type A.

1. Overall Thickness: 2.5 mm.

C. Colors and Patterns: See Finish Schedule on Drawings.

D. Sheet Width: 79 inches.

E. Seaming Method: Heat welded.

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2. N.B.S. Smoke chamber Test (ASTM-E-662): <450.

2.3 SLIP RESISTANT SAFETY FLOORING

A. Slip Resistant Sheet Vinyl Manufacturer: Altro USA, Telephone 800.377.5597, Fax 610.746.4325; E-Mail Assistance: info@altrofloors.com

B. Acceptable material: Altro "Walkway" (measurements and product weights given below are approximate):

1. Slip Resistance D .78 / W .80.
2. Weight: 4.97 lbs./square yard.
3. Thickness: 0.08 inches.
4. Roll Width: 79 inches.
5. Roll Length: 66 feet.
6. Color: As indicated on Finish Schedule on Drawings.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Reference Division 03 Section "Cementitious Floor Underlayment."

B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.

1. Adhesives shall have a VOC content of not more than 60 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.

1. Color: Match floor covering.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch radius provided or approved by manufacturer.
2. Cove-Base Cap Strip: Square metal provided or approved by manufacturer.

E. Floor Cleaner: Provide floor cleaning products as recommended by manufacturer.

F. Floor Sealer: Provide protective liquid floor sealer products as recommended by manufacturer.

G. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
4. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing. Verify results as in conformance to flooring warranty provisions of finish flooring manufacturers.
5. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours or other rate as accepted by flooring manufacturer.
b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement or other percent relative humidity as accepted by flooring manufacturer.
c. Verify results as in conformance to flooring warranty provisions of finish flooring manufacturers.

6. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.

a. Do not install floor coverings until they are the same temperature as space where they are to be installed.

7. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.

E. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of floor covering installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

H. Integral Flash Cove Base: Cove floor coverings 6 inches (152 mm) up vertical surfaces where indicated. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 INSTALLATION

A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floor coverings as follows:

1. Maintain uniformity of floor covering direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.

3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

a. Do not wash floor coverings until after time period recommended by manufacturer.

C. Floor Sealer: Remove soil, visible adhesive, and surface blemishes from floor coverings before applying sealer.

1. Apply two coats.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor coverings before applying liquid floor polish.

1. Apply four coats.

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Substantial Completion.

F. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Do not move heavy and sharp objects directly over floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 096516

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Resinous flooring systems including cove base and trim.
2. Preparation of substrate as recommended by resinous flooring manufacturer.

B. Related Sections include the following:

1. Division 01 Section “Equilibrium of Relative Humidity of Concrete Testing” for concrete slab testing procedures.
2. Division 01 Section “Sustainability Requirements.”
3. Division 03 Section “Cast-In-Place Concrete.”
4. Division 09 Section “Prefabricated Curbs” for flooring termination at refrigerated walk-ins and other food service equipment.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Certificates: For each resinous flooring component, from manufacturer.

E. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

F. Sample Warranty.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Section 01 33 23 – Submittal Procedures – LEED Submittals for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

B. Executed warranty certificate.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this Section.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer and certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

C. Material Standard: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch square floor area selected by Architect.

    a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRE-INSTALLATION CONFERENCE

A. Arrange a conference at the job site to coordinate resinous flooring and critical finish systems, to be attended by the General Contractor, Architect/Owner's Representative and personnel involved in the actual manufacture as well as the installation of the Work in this Section and of the following Sections:

1. Division 03 Section "Cast-In-Place Concrete."
2. Division 06 Section "Architectural Casework."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors.
2. No on site weighing or volumetric measurements allowed

B. Material shall be stored in a dry, enclosed area protected from exposure to moisture.

1. Temperature of storage area shall be maintained between 60 and 85-degrees F.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.10 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of one (1) full year from date of installation.

PART 2 - PRODUCTS

2.1 PERORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing according to ASTM D 635.

2.2 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

B. Basis of Design Products: The resinous flooring design is based on Stonclad UT Light Texture, total minimum thickness of ¼ inch as manufactured and installed by Stonhard, 253-259-4308. Manufacturer representative is Mike Agular magular@stonhard.com.

C. Equivalent products by one of the following manufacturers will be considered upon prior approval of a substitution request made in compliance with Division 01 Section "Product Substitutions and Options." Substitution requests must be accompanied by sufficient detailed documentation to allow the Architect to make a determination that the proposed product provides an equivalent system to the Basis-of-Design product.

1. Duraflex, 877-251-5418, www.dur-a-flex.com
2. Tufco, 800-364-0836, www.tufcoflooring.com
3. High Performance Systems, 800-928-7220, www.highperformancesystems.com

2.3 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

B. System Characteristics:

1. Color and Pattern: As indicated in drawings.
2. Wearing Surface: As indicated in drawings.
3. Overall System Thickness: Minimum ¼ inch.
4. Federal Agency Approvals: FDA approved for food-processing environments.

C. System Components: Manufacturer's standard components that are compatible with each other and are as follows:

1. Urethane Mortar: Liquid-rich, self-priming, textured, four component, polyurethane mortar system consisting of a urethane-urea binder, pigments and graded quartz aggregates.

a. Application Method: Notched Trowel.
b. Application Thickness: ¼ inch.

2. Finish Sealer: Two-component, pigmented, solvent-free, polyurethane coating.

a. Application Method: Squeegee and medium nap roller.
b. Application Thickness: 5-10 mils to achieve light texture.

3. Expansion/Isolation Joint Sealer Materials: Two-component, pourable polyurethane sealant with a minimum 400% percent elongation per ASTM D-638 and a Shore A Hardness of 50 per ASTM D2240.

    a. Backer Rod: Polyurethane foam rod or polyethylene backer rod one grade larger than the joint width.

4. Dynamic Cracks, Control and Construction Joints (if needed): Two-component, flexilbilized epoxy membrane in conjunction with 10 ounce fiberglass engineering fabric.
5. Integral Cove Base: Four-component, urethane mortar with two-component finish sealer applied to the height indicated on Drawings and Finish Schedule.

    a. Radius at floor/wall interface shall be at a ¾" minimum.
    b. Metal Cove Termination Strip: 1/8" x ½", "L" shaped, zinc or equivalent metal, cove strip fastened to wall substrate at cove height indicated on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.

B. Moisture Testing: Test horizontal substrates to determine acceptable dryness. Test method as recommended by resinous flooring manufacturer.

1. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.
2. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lbs per 1,000 sq. ft. per 24 hours.
3. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

    a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

3.2 MIXING

A. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

1. Mix components only in amounts that can be applied within recommended application life.
2. Discard materials not used within application life.

3.3 APPLICATION

A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. Apply uninterrupted except at divider strips, sawn joints, or other types of joints indicated or required.
4. Uniformly spread mortar over substrate using manufacturer’s specialty designed screed applicator. Use notched finishing trowels and spiked rollers to smooth the material to the required thickness. Broadcast texture aggregate into the wet mortar after achieving required thickness.

B. Finish Sealer: Sweep and vacuum off unbonded aggregate. Mix and apply finish sealer with strict adherence to manufacturer's installation procedures to both floor and coved base surfaces.

C. Integral Cove Base: Apply cove base mix to wall surfaces in conjunction with resinous flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

D. Expansion and Isolation Joints: Mix and apply sealant to properly prepared cut joints (if any). The use of a polyethylene backer rod should be used in expansion and/or isolation joints. Sealant shall be applied at a depth of half the width of the joint.

E. Dynamic Crack, Control, and/or Construction Joints: Prior to installation of Resinous Flooring, mechanically rout cracks and joints to a depth of 3/8” minimum and at a 45 degree angle to create a “V” into the concrete substrate following the crack and/or joint. Apply manufacturer’s recommended filler at a 30 mil thickness six inches on each side of crack or joint and filling the V. Immediately place 10 ounce woven fiberglass engineering fabric into uncured filler and saturate with additional filler applied with a medium nap roller.

3.4 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.5 PROTECTION OF ADJACENT WORK

A. General: Resinous floor system will be installed in locations where other adjacent finish materials, including ornamental metal, lath and plaster, and other finish assemblies may already be in place. Protect all adjacent surfaces during installation and finishing.

1. Installed adjacent finishes shall be completely isolated from epoxy coating system installation. Provide Plastic ("Visqueen") wrap and mask all edges.
2. Provide constant supervision and immediate clean up throughout resinous floor system installation.
3. After resinous floor system has fully cured, remove protection from adjacent surfaces and wipe down surfaces using clean, cotton towels.

3.6 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process

1. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096750 PREFABRICATED CURBS

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY:

A. This section includes hygienic prefabricated polymer composite curbs.

1.3 RELATED WORK:

A. Division 09 Section “Resinous Flooring” for coordination of flooring edge with prefabricated curbs.

B. Division 11 Section “Food Service Equipment”

1.4 QUALITY ASSURANCE:

A. Manufacturer’s Qualifications: Manufacturer with a minimum of three (3) years’ experience in providing items of type specified.

1. Obtain wall and door protection from single manufacturer.

B. Installer’s Qualifications: Installers are to have a minimum of three (3) years’ experience in the installation of units required for this project.

1.5 SUBMITTALS:

A. Shop Drawings: Show design and installation details.

B. Manufacturer's Literature and Data: For each type of product indicated.

C. Samples for Verification: Fore each type of prefabricated curb indicated, full height, 6 inches long.

D. Manufacturer’s qualifications.

E. Installer’s qualifications.

F. Manufacturer’s warranty.

1.6 DELIVERY AND STORAGE:

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.

B. Protect from damage from handling and construction operations before, during and after installation.

C. Store in a dry environment of approximately 70 degrees F for at least 48 hours prior to installation.

1.7 WARRANTY

A. Manufacturer Warranty: Manufacturer shall warranty their wall and door protection for a minimum of five (5) years from date of installation and final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Polymer Curbs as manufactured by PolySto Hygienic Curbs and represented by Stonhard, 253-259-4308. Manufacturer representative is Mike Agular magular@stonhard.com.

B. Alternate manufacturers and products of equivalent design and quality will be considered via substitution request per Division 01 Section “Product Substitution Options.”

2.2 PREFABRICATED CURBS - GENERAL

A. Product Description: full core homogeneous polyester-quartz polymer curbs that offer food safety and waterproofing in heavy duty conditions. Curbs should be designed with beveled top edge to aid the run off of water and cleaning products and with a curved or sloped coving to the floor to avoid build-up of dirt. Curbs should be finished with a smooth, non-porous and easy to clean surface. Joints between the curbs and wall should always be sealed with a curved food grade silicon seal or two-component PU sealant in such a way that water runs off.

B. Curb Configurations:

1. Coved: OP20F, OP30F, IP40F.
2. Straight: IP40R.
3. Recessed to receive seamless cove: OP20RB, OP30RB, IP40RB

2.3 WALL BASE PROTECTION CURBS

A. Prefabricated polymer composite curbs, HACCP compliant. PolySto Systems:

1. Coved:

a. OP20F: 7.87” Height, 1.18” thick, 1.97” thick at base of cove.
b. OP30F: 11.81” Height, 2.36” thick, 2.95” thick at base of cove.
c. IP40F: 15.75” Height, 3.94” thick, 4.53” thick at base of cove.

2. Straight:

a. IP40R: 15.75” Height, 3.94” thick

3. Recessed to receive seamless cove base

a. OP20RB: 7.87” Height, 1.18” thick, 2.36”H x .39”depth reveal.
b. OP30RB: 11.81” Height, 2.36” thick, 2.36”H x .39” depth reveal.
c. OP40RB: 15.75” Height, 3.94” thick, 1.97”H x .39” depth reveal.

2.4 ACCESSORY MATERIALS:

A. Internal and External corner pieces per drawings and as required.

B. Door end pieces per drawings and as required.

C. Wall strip protection PolySto PE500 per drawings and as required.

D. Food safe single component sealants, PolySto Food Safe Sealant.

E. Food safe two-component chemical weld sealant, PolySto Hygiseal.

F. Hard Fixed Glues, PolySto Hard fixed hybrid polymer adhesive.

G. Adhesive, PolySto Chemfix 2-component epoxy adhesive to anchor curbs.

H. Maintenance Cleaner: PolySto Sanicoat.

I. In heavy-duty areas, curbs should be anchored into the structural floor slab.

PART 3 - INSTALLATION

3.1 Hygienic Wall Curbs:

A. Install PolySto curbs on walls in accordance with manufacturer's instructions.

B. Utilize proper sealants per manufacturer’s instructions.

3.2 Schedule: Provide prefabricated curbs at walls of refrigerated walk-ins and other food service equipment where Division 09 Section “Resinous Flooring” is scheduled.

3.3 Cleaning and Protection:

A. Protect curb materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. Clean curbs after protection is removed per manufacturer’s recommendations.

END OF SECTION 096750

SECTION 097710 - PLASTIC WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes:

1. Homogenous Semi-rigid Polyvinyl Chloride (PVC) wall panels.
2. Fiberglass Reinforced (FRP) Wall Panels

B. Related Sections:

1. Division 01 Section “Sustainable Requirements.”
2. Division 10 Section “Door and Wall Protection” for stainless steel wall panels.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility for Wall Panels: Obtain each color, class and finish of panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Installer Qualifications: Engage an experienced Installer who has a minimum of five years experience and has successfully completed installations similar in material, design, and extent to that indicated for Project. Provide proof of experience if required by Architect.

1.4 SUBMITTALS

A. Manufacturer’s literature describing product and detailing installation methods.

B. Shop drawings indicating the location of each panel and joining method.

C. Sample of panel no smaller than 6 inches by 8 inches along with each accessory item including pre-formed corners and joint strips.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Cut sheets or letters from product manufacturers indicating that gypsum board, acoustic ceiling systems, wall base, wall covering products comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products

1.6 PRODUCT HANDLING

A. All materials shall be inspected immediately upon delivery and defects reported. Remove panels from shipping skid and restack on a solid, flat, dry surface. Do no stack on fresh concrete floors or other surfaces that may emit moisture. Lay panels flat. Do not store on edge. Panels should be acclimated at least 24 hours in temperature and humidity conditions approximating the operating environment of the finished room. Damaged or deteriorated materials shall be removed from the premises.

PART 2 - PRODUCTS

2.1 REQUIREMENTS

A. All gypsum board, acoustic ceiling systems, wall base, wall covering products used at the project shall comply with the requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda (Section 01350). The following product certifications indicate compliance with the standard: FloorScore, Greenguard Children & Schools, SCS Indoor Advantage Gold, and California High Performance School low-emitting products.

2.2 PVC WALL PANELS

A. Basis of Design Product: The design for PVC wall panel covering is based on Altro “Whiterock.” Subject to compliance with requirements, provide the named product or another product that has been approved prior to bid.

1. Fire Rating per ASTM E 84: Class A.
2. Finish: Smooth.
3. Thickness: 0.10 inches.
4. Impact Resistance: ASTM D5420: Exceeds 160 inch lbs.
5. Water Absorption: ISO 62: 24 hours-0.030%; 168 hours-0.093%; 216 hours-0.106%.
6. Sizes: 100 x 98 inches or 118 x 124 inches.

B. Seams: All panel edges and all inside and outside corners shall be heat welded using manufacturer's vinyl welding rods, sealant and tools.

C. Accessories: Vinyl Welding Rod: Altro weld rod – WSR to match panel color.

D. Adhesives: Use only high quality construction grade polyurethane adhesives – AltroFix W39, a two-part resin-based polyurethane adhesive as recommended by manufacturer.

2.3 FRP WALL PANELS

A. Basis of Design Product: The design for FRP wall panel covering is based on Panolam Classic Collection FRP. Subject to compliance with requirements, provide the named product or another product that has been approved prior to bid.

1. Fire Rating per ASTM E 84: Class A.
2. Finish: Smooth.
3. Thickness: 0.09 inches.
4. Barcol Hardness: ASTM D2583:35 typical.
5. Water Absorption: ASTM D570: 0.2 percent typical.
6. Sizes: 48 inches by 120 inches.

B. Accessories: Color matched dividers, outside corners, inside corners, end caps and fastening rivets.

C. Adhesive: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances ad other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install products in strict accordance with manufacturer's instructions and approved submittals.

3.2 INSTALLATION PVC WALL PANELS

A. Wall Preparation: All surfaces must be free from dust and cleaned prior to installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the panels to debond.

1. Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.
2. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.

3. All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with manufacturer's recommended Sanitary Sealant.
4. Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with manufacturer's recommended Sanitary Sealant.
5. All pipes, fixing bolts, etc. extending through the panels should have a minimum 1/8" (3mm) expansion gap and be sealed using manufacturer's recommended Sanitary Sealant.
6. If fitting to door frames, these must be in place prior to installation of panels.
7. Prior to installation, it is advisable to complete any painting which comes in contact with the panels, as sealant used at junctions is non-paintable.
8. Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.
9. The panels must be stored on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.
10. First, check the rooms using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.3 INSTALLATION PVC PANELS

A. Install panels in accordance with the current published manufacturer's Installation Guide. All joints should be joined by approved methods as detailed in the installation guide.

3.4 CLEANING PVC PANELS

A. Panels can be cleaned with a diluted soap/detergent solution, subject to manufacturer approval.

B. When cleaning the panel surface, the temperature of water should not exceed 140° F.

C. Pressure cleaning with hot water may be used with the pressure nozzle a minimum of 2 feet away from the surface.

D. To reduce the buildup of static, cleaning the panels with an anti-static solution is recommended.

E. Stubborn stains use manufacturer's recommended cleaner or equivalent alkaline cleaner.

3.5 INSTALLATION FRP PANELS

A. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation.

B. Install panels with bottom edge located to clear top of resilient base.

C. Apply adhesive uniformly using adhesive manufacturers recommended trowel to the entire back of panels completely to the edge (100% coverage).

D. Lay FRP panels in place leaving approximately 1/8 inch between panels and 1/4 inch space top and bottom.

E. Follow adhesive manufacturer's recommendations for set and application times.

F. Apply pressure to entire panel face with laminate type roller, removing trapped air and ensure proper adhesion between surfaces.

3.6 ADJUSTING AND CLEANING FRP PANELS

A. Replace installations out of plumb and not aligned with adjacent panels and construction.

B. Clean panel face to remove soiling, stains, dust, and dirt using clean rags, and cleaning agents as instructed by manufacturer.

C. Leave installation clean, free of residue and debris resulting from work of this Section.

END OF SECTION 097710

dj/January 12, 2018

SECTION 099100 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Extent of painting work is indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of all interior and exterior exposed items of new surfaces except for pre-finished surfaces.

C. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

D. Except in Service and Storage Areas, work of this section includes field painting of all interior exposed mechanical and electrical items as listed, but not limited to the following:

1. Sheet metal.
2. Pipe and covered pipe.
3. Ductwork.
4. Grilles.
5. Vents.
6. Valves.
7. Plastic.
8. Electrical panels and doors.
9. Face panels.
10. Boxes.
11. Conduit.
12. Wire mold and fittings.
13. Wire chases.
14. Hangers.
15. Other mechanical and electrical items are to receive finishes as specified in Divisions 21 through 28.

E. “Paint” as used herein means all coating systems materials, including pre-treatments, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

F. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designed in “schedules.” Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these colors.

G. Following categories of work are not included as part of field-applied finish work.

1. Pre-Finished Items: Unless otherwise indicated do not include painting when factory-finishing or installer-finishing is specified for such items (but not limited to) as follows:

   a. Toilet enclosures.
   b. Prefinished partition systems.
   c. Acoustic materials.
   d. Architectural woodwork and casework.
   e. Finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.

2. Concealed Surfaces: Unless otherwise indicated, painting is not required on such surfaces as follows:

   a. Walls or ceilings in concealed areas and generally inaccessible areas.
   b. Foundation spaces.
   c. Furred areas.
   d. Utility tunnels.
   e. Pipe spaces.
   f. Duct shafts.
   g. Elevator shafts.

3. Finished metal surfaces unless otherwise indicated:

   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze.
   f. Similar finished materials.

4. Operating Parts Unless Otherwise Indicated:

   a. Mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.

H. Following categories of work are included under other sections of these specifications:

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, steel doors and frames and similar items.
2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.

I. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

J. Sprinkler Piping: Contractor shall include in his bid painting of all exposed sprinkler piping, hangers and brackets. It is the Contractor's responsibility to verify the extent of exposed sprinkler piping.

K. Related Sections include the following:

1. Division 07 Section "Water Repellants and AntiGraffiti Coatings" for Water Repellent and Antigraffiti Treatment applied to masonry.

L. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 REFERENCES: CODES, STANDARDS AND PRACTICES

A. General: Master Painters Institute (MPI), as distributed by the Master Painters & Decorators Association. 4090 Graveley Street, Burnaby, B.C. V5C3T6. Telephone 1-604-298-3875. Email, info@paintinfo.com.

1. MPI Architectural Painting Specification Manual is used in this specification. The manual is also used as a reference for material quality and workmanship. Where there are conflicts, the more stringent shall apply.

B. Steel Structures Painting Council (SSPC)

1. SSPC-SP 1 Solvent Cleaning
2. SSPC-SP 2 Hand Tool Cleaning
3. SSPC-SP 3 Power Tool Cleaning

C. The latest issues, revisions, amendments or modifications of the above referenced material in effect on the date of the Advertisement for Bids shall govern unless otherwise specified.

1.4 DEFINITIONS

A. Materials used shall not contain more than .06 percent lead by weight.

B. The work "provide" as used in this section, shall mean "furnish and install or apply complete in place."

C. The term "APSM" as used in this section refers to the Master Painters Institute "Architectural Painting Specification manual."

1.5 CONTRACTOR WARRANTIES

A. Contractor Warranty: The Contractor shall fully warrant and guarantee the work of this section against failure or non-performance for two years from the date of substantial completion. Failure or non-performance shall be corrected promptly upon discovery by the Owner. Correction work will follow project specifications.

B. Warranty not applicable for failure of substrates, or work by others.

C. Work in this section may be observed and tested by an independent testing and inspection agency selected by the Owner. The Owner pays the fees. Notify the agency at least 10 working days before starting work under this section. Allow full access to the work. Give full cooperation at all times to the inspector in the performance of their duties or observing and testing the work.

1. The inspector will make all tests necessary of the surfaces requiring preparation, sealant, painting and finishing to determine compliance with the contract documents. The Contractor is to give the inspector 24- hour notice when the Contractor will not be on site and before restarting work. The Contractor will furnish and pay for equipment and personnel necessary for accessing surfaces for observation and testing. Coordinate with the inspector.
2. Regardless of the number or frequency of observations by the inspector, the Contractor is fully responsible for quality control and compliance with plans and the contract documents.
3. The Contractor is to repair all test areas that are the result of destructive testing.
4. Specialist means an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field) with adequate resources to meet the schedule requirements of the project. This individual or firm must be regularly engaged in and maintain a regular force of workmen skilled in performing required work.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

C. Qualifications of Painters: Use only qualified journeyman painters for the surface preparation, mixing and application of paint on exposed surfaces; in the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

D. During preparation and painting, a foreperson will be on site to monitor the work. The foreman will be responsible for quality control for the painting Contractor.

E. Where there is conflict with any requirements of these plans and specifications, the more stringent shall apply.

F. A pre-work meeting will be held prior to starting work. Parties involved will be the painting Subcontractor including foreman, Contractor, Architect, and inspection agency.

1.7 SUBMITTALS

A. Product Data: Submit manufacturer’s technical information for products to be used on the project.

B. Samples: Prior to beginning work, Architect will furnish color selections for surfaces to be painted. Submit samples for Architect's review of color, gloss, and texture only on 8-1/2" x 11" hardboard, provide sample of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

1.8 LEED SUBMITTALS

A. Complete the LEED VOC Submittal Form as provided in section 013323 – Submittal Procedures – LEED Submittals for products in this section.

B. B. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

1.9 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer's stock number and date of manufacturer.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.

1. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.10 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F, unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F and 95 deg F, unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather to meet the schedule if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

E. Moisture content of exterior wood shall not exceed 15% and interior wood shall not exceed 8%.

F. Moisture content of concrete, GWB, cement stucco, cement board, concrete block, and brick and mortar shall not exceed 5%, unless the manufacturer permits higher moisture content.

G. Ph shall not be below 6.5 or exceed 9 unless manufacturer permits other ranges.

H. Provide a minimum of 40-candle power of light on surfaces while preparation and painting are underway.

1.11 EXTRA STOCK

A. Provide Owner one gallon of each major paint color and type.

B. List manufacturer, product, color name and number, gloss level, and where paint was applied.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Paint products manufactured or supplied by the following manufacturer are the basis-of-design products: Subject to compliance with requirements, provide products from the following manufacturer:

1. Sherwin-Williams Company (The).
2. Benjamin Moore.
3. *Rodda (Addendum 3)*

B. Alternate Manufacturers: Products other than the basis-of-design products may be used upon approval of pre-bid substitution request. Approval criteria include, but are not limited to, aesthetic acceptability as determined by the Architect, and whether use of a product other than basis-of-design product will result in revisions to other components of the Work.

2.2 INTERIOR PAINT

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings and Primers: VOC content of not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
4. Floor Coatings: VOC content of not more than 100 g/L.
5. Shellacs, Clear: VOC content of not more than 730 g/L.
6. Shellacs, Pigmented: VOC content of not more than 550 g/L.
7. Dry-Fog Coatings: VOC content of not more than 400 g/L.
8. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
9. Pretreatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following.

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzine.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphtalene.
    w. Toluene (methylbenzene).

x. 1,1,1-trichloroethane.
y. Vinyl chloride.

2.3 MATERIALS

A. Unless otherwise indicated, furnish scheduled products in accordance with the referenced Manual, including paint, varnish, stain, enamel, lacquer, fillers, primers, pre-treatments, and related products for prime, intermediate, and finish coats.

B. Material Quality: Provide manufacturer's best-quality sundry product as needed.

1. Proprietary Names: Use of manufacturer's proprietary paint and sundry product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Primers for ferrous metal are to be solvent born rust inhibitive primers.

D. Masonry and Concrete Coatings: See Division 07 Section “Water Repellants and AntiGraffiti Coatings” for Water Repellent and Antigraffiti Treatment applied to concrete and masonry.”

E. Color Pigments: Pure, non-fading, applicable types to suite substrates and service indicated.

F. Prepare and apply material as printed by the manufacturer for mileage, handling, and application, and condition requirements.

2.4 PRIMING (Addendum 3)

A. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely

completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area. Do not paint over dirt, rust, scale, grease, mortar droppings, cement slurry, foreign material, moisture, or scuffed surfaces.

C. Follow surface preparation requirements of these specifications, and referenced manuals.

3.2 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with the referenced manual including the guide specifications and as herein specified, for each particular substrate condition. Where there is conflict, the more stringent will apply.

1. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others, or coatings on existing surfaces to be repainted.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items. Clean surfaces to be painted before applying paint or surface treatments. After completion of painting operations in each space of area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates. Remove dust, weld smoke, oil, rust, dirt, mortar droppings, concrete slurry, foreign material and grease.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to these specifications, and the APSM instructions for each particular substrates exposure.

1. Sand surfaces or substrates and between coats to achieve a smooth finish.
2. Fill nicks, gouges, dents, joints, holes, tool marks and cracks in substrates.
3. Provide barrier coats over incompatible primers.
4. Install sealant at hollow metal prior to the finish coat application.
5. Dull glossy surfaces prior to priming or painting.

D. Cementitious Materials: Prepare concrete, concrete masonry units surfaces to be painted.

1. Have mason remove excess mortar and fill bug holes and cracks before starting painting work.
2. Remove residual efflorescence after masonry cleaning, chalk, dust, dirt, grease, marks, cement splatter, concrete slurry, loose material, oils and release agents.

Roughen as required to remove glaze by acid etch or power tool cleaning. Provide a surface profile of 2 or more mils.

3. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application.
4. Clean concrete floors to be painted with a solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting. Achieve a surface profile of 2 or more mils.

E. Wood: Clean surfaces of dirt, oil, marks and other foreign substances with scrapers, mineral spirits and sand paper. Sand surfaces to ease edges, smooth wood bruises and splinters, and sharp corners exposed to view.

1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of whit shellac or other recommended knot sealer before applying primer.
2. After priming, fill holes, cracks, dents and splits in finish surfaces with putty or plastic wood filler.
3. Wood substrates to be stained or receive clear finishes are to be puttied with colored putty to match the wood grain. Sand smooth after each coat.
4. Prime, stain and seal, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides and backsides of wood, and paneling.
5. When transparent finish is required, backprime with spar varnish.
6. Back prime paneling on interior partitions where concrete, masonry, plaster, or other wet wall construction occurs on backside.
7. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

F. Ferrous Metals: Clean ferrous-metal surfaces that have not been shop coated as required by SSPC-SP-3, to remove rust, dirt, weld smoke, weld spatter, factory treatments, loose material and scale, and other foreign material. Treat welded areas with phosphoric acid.

1. Primed Ferrous Metals: Power tool clean to meet SSPC-SP-3, to remove rust, weld spatter, weld smoke, dirt, foreign material, and loose and pealing paint. Treat welded areas with phosphoric acid. Touch up bare areas with the same generic primer. Sand smooth.
2. Trusses, beams, and ceiling decking are to be cleaned by others. Provide minor surface preparation and priming. Remove dust before painting.
3. Galvanized Surfaces including ducts and metal floor/roof decking: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil, white rust, weld smoke and other surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods. Prime exterior surfaces with Sherwin Williams's Galvite and interior surfaces with Opti-Bond or equal.

G. Touch up bare and prepared areas and shop-applied prime coats that have been damaged. Touch up material shall be the same as the shop primer.

H. Gypsum Wallboard: Patch minor scratches, gouges, dents, cracks and imperfections. Remove foreign material. Dust surfaces with damp rage. Prime surfaces after moisture and ph are verified.

1. Touch up primed GWB prior to finish application.

I. PVC: Scuff sand to create a profile. Solvent clean to remove oils and foreign material.

J. MDO and MDF: Sand rough areas. Wipe to remove dust and foreign material.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in clean conditions, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes, are indicated in "schedules" of the contract documents.

a. Provide finish coats that are compatible with prime paints used.
b. Paint systems are to be premium unless noted otherwise.
c. Apply additional coats when undercoats, stains, colors, or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
d. Paint surfaces behind movable equipment, rubber base, and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment, installed panels, cabinets, or furniture with prime coat only before final installation of equipment.
e. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
f. Paint back sides of access panels, and removable or hinges covers to match exposed surfaces.
g. Finish exterior doors on tops, bottoms and side edges same as exterior and interior faces, unless otherwise indicated. Omit first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, except on hollow metal doors and frames unless otherwise indicated.
h. Paint gypsum board backing for plastic laminate and fiberglass reinforced panel wainscot.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coatings to permit proper drying. Acrylics are to dry at a minimum of 4 hours. Do not recoat solvent born coatings until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated.

D. Mechanical items to be painted include, but are not limited to the following:

1. Painting of all interior grilles to match adjacent surfaces (except in service or storage areas).
2. All surface applied mechanical items shall be painted to match adjacent surfaces (except for service and storage areas).
3. See Part 1 "Description of Work" for expanded list.

E. Electrical items to be painted include, but are not limited to, the following:

1. Conduit, wire mold, and fittings, hangers, chases, where exposed in occupied areas.
2. Faces of all electrical panels to match existing surfaces (except for service and storage areas).
3. See Part 1 "Description of Work" for expanded list.

F. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Prime gypsum board prior to all wainscot applications, including plastic laminate and vinyl wall covering.

1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

G. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

I. Prime all wall locations that are to receive Vinyl Coated Fabric Wall Covering as shown in the Project Drawings and as specified in Division 09 Section "Vinyl Coated Fabric Wall Covering."

3.5 FIELD QUALITY CONTROL

A. Cooperate and coordinate with the inspection agency during the course of the work.

B. The Owner reserves the right to invoke the following material test procedures at any time and as often as the owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed and certified in the presence of the Contractor.

C. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

1. Quantitative material analysis.
2. Abrasion resistance.
3. Apparent reflexivity.
4. Flexibility.
5. Washability.
6. Absorption.
7. Accelerated weathering.
8. Dry opacity.
9. Accelerated yellowness.
10. Recoating.
11. Skinning.
12. Color retention.
13. Alkali and mildew resistance.
14. Volume solids

D. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with the manufacturer's specifications the project specifications and specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces or replace the substrate, if on repainting with specified paint, the two coatings are incompatible.

3.6 CLEAN-UP AND PROTECTION

A. Clean-up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

1. Upon completion of painting work clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. At completion of work of other trades, touch-up and restore damaged or defaced painted surfaces. Trade damage correction is to be paid for by others. Touch up is not acceptable. Paint corner to corner and top to bottom of affected area.

3.7 EXTERIOR PAINT SCHEDULE (Systems and gloss levels are found in the MPI, APSM.)

A. Concrete (where indicated to receive paint): Ext. 3.1K. Acrylic. Gloss Level 3.

B. CMU, Brick and Concrete Clear Finish: Refer to Division 07 Section "Water Repellants and Anti-Graffiti Coatings."

C. Painted Hollow Metal: Ext. 5.1D, Alkyd. Gloss Level 5.

D. Ferrous Metal: Ext. 5.1D, Alkyd. Gloss Level 5.

E. Galvanized Metal: (Including underside of preformed metal roofing where exposed) Ext. 5.3B, Alkyd. Gloss Level 5.

F. Plastic and PVC: Ext. 6.8, Acrylic. Gloss Level 3, or match surrounding painted surfaces.

3.8 INTERIOR PAINT SCHEDULE

A. Gypsum Wallboard, Standard: INT. 9.2M, Latex, Gloss Level 3.

B. Gypsum Wallboard, Epoxy: INT 9.2F, Gloss Level 5.

C. Gypsum Wallboard, Marker Board Paint (MBP): Equal to Wolf Gordon "Wink" water based finish consisting of non-pigmented liquid emulsion (Part A), polymer hardener (Part B) and surface conditioner. ASTM E84, Class A rated. Apply over white painted drywall surface per manufacturer's instructions.

D. Wood Trim, MDF, MDO: INT 6.4R, Acrylic Enamel. Gloss Level 3.

E. Ferrous Metal: INT 5.1E, Gloss Level 5.

F. Hollow Metal: INT Institutional Low Odor/VOC, 5.1R, Gloss Level 5, meet Green Seal Standard & VOC Range E3 or GPS-1.

G. Galvanized Metal: INT 5.3N, Gloss Level 5, meet Green Seal Standard & VOC Range E3 or GPS-1.

H. Galvanized Roof Deck: INT 5.3N, Gloss Level 1, meet Green Seal Standard & VOC Range E3 or GPS-1.

I. CMU, Clear Finish: Refer to Division 07 Section "Water Repellants and Anti-Graffiti Coatings".

END OF SECTION 099100

SECTION 101100 – VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Markerboards.
2. Tackboards.
3. Glass panel marker board.
4. Visual display rails.

B. Related Sections include the following:

1. Division 10 Section "Display Cases" for display cases.

1.3 DEFINITIONS

A. Tackboard: Framed tackable surfaces.

B. Visual Display Boards: Markerboards and tackboards.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show location of panel joints.
2. Show location of special-purpose graphics for visual display surfaces.

C. Samples for Verification: For each type of visual display surface indicated and as follows:

1. Visual Display Surface: Not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Accessories: Full-size Sample of each type of accessory.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl fabrics.

E. Maintenance Data: For visual display surfaces to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces become slick or shiny.
c. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- thick ground coat, and color cover coat; and concealed face coated with primer and 1.7-to-2.5-mil-thick ground coat.

1. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F.

B. Hardboard: AHA A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade 1-M-1, made with binder containing no urea formaldehyde.

D. Natural-Cork Sheet: MS MIL-C-15116, Type II seamless single-layer, 1/4-inch- thick, compressed fine-grain, bulletin board quality, natural-cork sheet; face sanded for natural finish.

E. Vinyl Fabric: FS CCC-W-408, Type II, weighing not less than 20 oz./ly. (452 g/sq. m); with flame-spread index of 25 or less when tested according to ASTM E 84. Refer to Finish Schedule drawing sheet for color.

F. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly (Fixed and Sliding): Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 24 gauge porcelain-enamel face sheet with high-gloss finish, one piece without seams. Provide tack strip at top of marker board.

1. Basis-of-Design Product: The design for each visual display surface is based upon on the product specified. Subject to compliance with requirements, provide named product or a comparable product by one of the other manufactures specified:

a. PolyVision, A Steelcase Company; e3 Environmental Ceramic steel markerboard.

2. Acceptable Manufactures:

a. ADP/Lemco, Inc.
b. Claridge Products & Equipment, Inc.
c. Ghent Manufacturing Inc.
d. Best-Rite Manufacturing.
e. Polyvision, Platinum Visual Series.

3. Medium Density Fiber (MDF) Core: ½-inch thick; with 0.015-inch- thick, aluminum sheet backing.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type. Sizes of fixed markerboards as indicated on Drawings as follows:

   a. MB4: 4 feet wide, 4 feet high.
   b. MB6: 6 feet wide, 4 feet high.
   c. MB8: 8 feet wide, 4 feet high.
   d. MB8x5: 8 feet wide, 5 feet high.

5. Color: Selected from manufacturer’s full range.

2.3 TACKBOARD ASSEMBLIES

A. Manufacturers or approved:

1. ADP/Lemco, Inc.
2. Claridge Products & Equipment, Inc.
3. Ghent Manufacturing Inc.
4. PolyVision Corporation.

B. Natural Cork Tack Assembly: 1/4-inch- (6-mm-) thick, cork sheet factory laminated to 1/4-inch- (6-mm-) thick particleboard backing.

C. Joint Accessories: Manufacturer’s standard, exposed trim at butt joints.

D. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific tack wall panels and substrate application, as recommended in writing by visual display surface manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Color: Selected by Architect from manufacturers full range.

2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.

1. Factory-Applied Trim: Manufacturer's standard.
2. Finish of Exposed Frame: Satin anodized.

B. Chalktray: Manufacturer's standard, continuous.

1. Provide at all markerboards

2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

C. Map Rail: Provide the following accessories:

1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
2. End Stops: Located at each end of map rail.
3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.
4. Flag Holder: One for each classroom. Verify flag dowel size with Owner.

2.5 GLASS PANEL MARKER BOARD

A. Basis-of-Design: Provide products manufactured by Clarus Glassboards LLC. 8715 Harmon Road, Fort Worth, TX 76177 (888) 813-7414:

1. Product: Architectural Series.
2. Color: C101, Smooth White.
3. Core: Magnetic.
4. Locations: As indicated on Drawings.

B. Provide installation accessories as required for a complete installation.

C. Provide the following loos accessories at each installed location:

1. Magnetic Marker and Eraser Holder Box:

   a. Size: 1-3/4 inches x 2-1/4 inches x 12 inches.
   b. Color: F101-White.
   c. Quantity: 2.

2. Marker Cradle Hook:

   a. Size: 1 inch × 1-1/4 inches.
   b. Quantity: 8.

2.6 VISUAL DISPLAY RAILS

A. General: Manufacturer’s standard, aluminum framed, tackable visual display surface fabricated into narrow rail shape and designed for displaying material.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bangor Cork Company, Inc.
2. Best-Rite Manufacturing
3. Claridge Products & Equipment, Inc.
4. Ghent Manufacturing Inc.
5. Platinum Visual Systems; a division of ABC School Equipment.

2.7 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.

C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.
3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.

D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

E. Vertical Sliding Porcelain Enamel Markerboards: Provide vertical sliding units with all corners reinforced with angles to strengthen unit and eliminate vibration.

1. Panels to be equipped with manufacturer’s standard neoprene ball-bearing end rollers, four on each side of the sliding panel. Counterbalance the sliding panel with lead counterweights supported by steel aircraft cable over ball-bearing sheaves; with removable cover plate for access to counterweights. Provide rubber bumpers at top and bottom of sliding panel.
2. Vertical sliding units to be completely assembled at the factory and erected on a test panel before shipping.
3. All sections to be properly fitted and all units to be thoroughly tested, then taken apart for shipping. Components are to be clearly marked for easy reassembly on the job.
4. Markerboard:

a. Back Panels:

i. Face Sheet: Porcelain-enamel face sheet with 0.021 inch uncoated thickness.
ii. Core: ½” Medium Density Fiberboard (MDF).
iii. Backing: Steel

2.8 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing for visual display surfaces.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.

1. Attach chalktrays to boards with fasteners at not more than 12 inches (300 mm) o.c.

3.5 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100

SECTION 101400 - IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 GENERAL

A. Comply with general provisions of the Contract, including General, Supplementary, and other Conditions, and with Division 1 General Requirements sections.

1.2 SUMMARY

A. Work includes:

1. Occupancy limitations.
2. Accessibility signs.
3. Exterior building signs.

B. Related Sections include the following:

1. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
2. Division 26 Sections for electrical service and connections for illuminated signs.
3. Division 26 Section "Identification" for labels, tags, and nameplates for electrical equipment.
4. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Acrylic sheet.
2. Die-cut vinyl characters and graphic symbols.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Panel Signs: Not less than 7 inches square. Approved sample may be incorporated into the project.

E. Sign Schedule: Use same designations indicated on Drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.6 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.2 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. APCO Graphics, Inc.
2. Best Sign Systems Inc.

B. Interior Room Number Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner. Surround sign with anodized aluminum frame anchored to the wall with tamper proof screws. Hold sign in frame with set screws in top and bottom on both sides of frame. Comply with the following requirements:

1. Acrylic Sheet: 0.060 inch thick.
2. Edge Condition: Square cut.
3. Corner Condition: Rounded to radius indicated.
4. Mounting: Framed.

a. Wall.
b. Spanner head anchors for substrates encountered.

5. Color: As selected by Architect from manufacturer's full range.

a. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.
b. Provide slot on both side of metal trim at blind inserts.

6. Size: As indicated in drawings (Addendum 2)

C. Permanent Function Signs:

1. ~~*8-1/2 inches by 3 inches with*~~ *(Addendum 2)* 1/32 inch raised copy and embossed Grade 2 Braille on 1/8 inch Plexiglas separated from a backing piece of 1/16 inch Plexiglas spaced with 1/32 inch spacer. Sign shall identify room name and number. Surround sign with anodized aluminum frame anchored to the wall with tamperproof screws. Provide backer sign at locations where attached to glazing. Hold sign in frame with setscrews in top and bottom of both sides of frame. Install frame to the latch side of the door, 60 inches from the centerline of the sign to the floor. See drawings for layout.
2. ~~*Provide one (1) at the kitchen, changing room, and storage room*~~*. Size: As indicated in drawings. (Addendum 2)*

D. Toilet Room/Handicapped Symbol Signs:

1. Modulex-Interior 30 or approved.
2. Comply with code requirements for size, symbol and colors.
3. ~~*Size approximately 8 inches by 8 inches*~~*. Size: As indicted on drawings (Addendum 2)*
4. Provide signs at all toilet facilities.

E. Maximum Occupancy Signs:

1. Provide plaque signs similar to room name signs - verify actual occupant load and location of sign with architect.
2. ~~*Size: 6" high x 10" long*~~ *Size: As indicated on drawings. (Addendum 2)*
3. Quantity (2) mounted at Architect's directions.

F. Exit Sign

1. Provide (1) ~~2"x3"~~ sign stating "EXIT" at each exterior door. Typically to be mounted on a mullion adjacent the door. Architect to provide exact location.
2. *Size: As indicated on drawings. (Addendum 2)*

~~G. Engraved Plastic Laminate Type: *(Addendum 2)*~~

~~1. Engraving Stock: "Norplex," Micarta" or approved, 1/8 inch plastic laminate, colors as selected.~~
~~2. Type Face: Incised letter, helvetica medium style.~~
~~3. Size: 5/8 inch high letters and as required to meet local codes and ordinances.~~
~~4. Install with approved type stainless steel or brass Philips head screws as selected.~~
~~5. Provide the following signs and locate as directed:~~

~~a. "FIRE SPRINKLER MAIN VALVE" (1 at door to mechanical room)~~
~~b. "ELECTRICAL ROOM" (2 total, 1 on each exterior door)~~
~~c. "MECHANICAL ROOM" (1 at door to mechanical room)~~

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for three years for application intended.

2.5 ILLUMINATED ALUMINUM LETTERING

A. Manufacturer: Sign Solutions or equivalent. Contact info www.signsolutions.us; 406-777-1004.

B. Type Face: Optima 404; upper case.

C. Finish: anodized aluminum or stainless steel; color as selected by Architect.

D. Letters cast from prime 514 alloy aluminum or stainless steel.

E. Locate as directed; install per manufacturer's recommendations for a 1-1/2 inch projected mounting.

F. Backlit LED illumination.

G. Provide individual letters as follows:

1. "PATIENT SUPPORT CENTER" (all caps)

   a. Height: 24 inches.
   b. Location: As indicated on Drawings.

2. "22"

   a. Height: 24 inches.
   b. Location: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
2. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102213 - WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 00 and 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Standard-duty wire mesh partitions.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 08 Section "FinishHardware" for lock cylinders and keying.
2. Division 09 Section "Painting" for field painting wire mesh partitions.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data for each type of product specified, consisting of manufacturer's specification, technical data, and installation instructions.

B. Shop Drawings showing fabrication and installation of wire mesh partitions, including plans, elevations, and large-scale details showing anchorage and accessory items. Provide location template drawings for items supported or anchored to permanent construction.

C. Samples of a 12-by-12-inch wire mesh panel constructed of specified frame members, wire mesh, and color charts.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing wire mesh partitions similar to those indicated for this Project and that have a record of successful in-service performance.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations for wire mesh products by accurate field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication and delivery schedules with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee location dimensions and proceed with fabricating wire mesh products without field measurements. Coordinate wall, column, floor, and ceiling construction to ensure that actual location dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Southwest Solutions Group Style 840. Subject to compliance with requirements, products from the following manufacturers will be considered:

1. Acorn Wire and Iron Works, Inc.
2. G-S Company (The).
3. Hoosier Fence Co., Inc. (The).
4. Indiana Wire Products, Inc.
5. Kentucky Metal Products Co.
6. King Wire Partitions, Inc.
7. Lakeside Wire and Iron Co.
8. Miller Wire Works, Inc.
9. SpaceGuard Products.
10. Wire and Iron Products, Inc.
11. WireCrafters, Inc.

2.2 MATERIALS

A. Steel Wire: ASTM A 853.

B. Steel Channels, Angles, Plates, and Bars: ASTM A 36 (ASTM A 36M).

C. Cold-Rolled Steel Channels: Formed from steel sheet.

D. Square Steel Tubing: Cold-formed structural steel tubing, ASTM A 500.

2.3 STANDARD-DUTY MESH PARTITIONS

A. Mesh Panels: 10 gauge steel wire crimped and woven in to 2" x 1" opening rectangular mesh, securely welded into a frame of 1 1/4" x 1 1/4" x 1/8" steel angle factory punched with slotted holes to accept mounting hardware.

B. Posts: Made of 2" x 2" x 14-gauge steel tubing with 2" x 7" x 1/4" steel flat base plates welded to each tube. Posts are factory drilled with holes to accept mounting of mesh panels.

2.4 DOORS

A. Sliding Doors: Constructed of the same materials as the panels with two 1/4" x 3/4" horizontal stiffeners across the width, and two vertical 1/4" x 3/4" stiffeners from center to top or bottom. Equip with two 4-wheel trolley trucks and 1 7/8" x 2 3/8" door track.

1. Width: as indicated in the Project Drawings.
2. Locking: Cylinder locking keyed to master key system.
3. Door Latches: Provide lever handle door latch that will disengage a strike to open the partition door.

2.5 FABRICATION

A. Do not use components less than sizes indicated. Use larger-size components as recommended by partition component manufacturer.

B. Provide bolts, hardware, and accessories for complete installation.

C. Finish: Manufacturer's standard, shop-applied enamel finish. Provide manufacturer's standard finish color.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

A. Erect partitions plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings and manufacturer's recommendations.

B. Provide additional field bracing as shown or necessary for rigid, secure installation. Installer to provide additional clips and bracing as required.

3.3 ADJUSTING AND CLEANING

A. Adjust moving components for smooth operation without binding.

B. Touch up damaged finish after completing installation using field-applied paint to match color of shop-applied finish.

END OF SECTION 102213

dj: September 5, 2017

SECTION 102600 WALL & DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This section includes the following:

1. Stainless steel wall protection system including wall panels, outside and inside corners, and edge bars.
2. Heavy duty aluminum wall protection system including wall panels, outside, and base boards.

B. Related Sections:

1. Division 08 Section “Hardware” for metal armor, kick, mop, and push plates.
2. Division 09 Section “Plastic Wall Panels” for PVC and FRP wall protection.
3. Division 09 Section “Prefabricated Curbs” for plastic wall base curbing at food service equipment.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s current printed product literature, specifications, installation instructions, and field reports.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories.

C. Samples: Submit duplicate sample pieces of material, as well as accessory pieces.

D. Quality Assurance Submittals: Submit the following:

1. Manufacturer’s Instructions: Current published manufacturer’s installation and maintenance instructions.

E. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. Obtain all components of wall protection system from a single manufacturer.

B. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

C. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver, store and handle materials in accordance with Division 01 Section "Product Requirements."

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

E. Store panels in temperature controlled environments.

1.6 1.09 PROJECT CONDITIONS

A. Maintain air temperature and structural base temperature at installation area between 41F (5C) and 80F (26C) for 48 hours before, during and 24 hours after installation.

1.7 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: ProTek Systems, Inc., 800-598-2153, www.proteksystem.com.

B. Alternate manufacturers and products of equivalent design and quality will be considered via substitution request per Division 01 Section "Product Substitution Options."

2.2 STAINLESS STEEL WALL COVERINGS

A. Basis of Design: WPS-12 stainless steel wall system as manufactured by ProTek.

B. Stainless Steel Wall Covering Panels:

1. Material: Type 304 #4 satin stainless steel sheet. Consult factory for recommended gauge.
2. Standard Sheet Sizes: 4ft x 8ft or 4ft x 10ft
3. 1/2" offset construction
4. Finish: #4 satin

C. Inside Corners and Outside Corners:

1. Material: Type 304 #4 satin stainless steel. Consult factory for recommended gauge.
2. Standard sizes: 4ft, 8ft, or 10ft
3. 1/2” offset construction
4. Finish: #4 satin

D. Edge Bar / Top Cap:

1. Material: Type 304 brushed stainless steel.
2. Standard sizes: 12ft
3. Profile: 1” x 1/8”
4. Brushed finish

E. Mounting Method: Adhesive using manufacturer’s recommended adhesive for the applicable substrate.

2.3 HEAVY DUTY ALUMINUM WALL PROTECTION

A. Basis of Design: SD-50 Super Duty wall system as manufactured by ProTek.

B. Wall Panels:

1. Material: Alloy 5052-H32 .050” aluminum sheet coated with Super Duty polyurea.
2. Stock Size: 4ft x 8ft or 4ft x 10ft
3. Color: As selected by Architect from manufacturer’s standard range

C. Base Board:

1. Material: Alloy 6061 extruded aluminum rectangle coated with Super Duty polyurea.
2. Stock sizes: 8ft, 10ft, or 12ft
3. Profile: 1/4" x 4”
4. Color: Same color as wall panels.

D. Outside Corners:

1. Material: Alloy 5052-H32 .080" aluminum coated with Super Duty polyurea.
2. Stock sizes: 4ft, 8ft, or 10ft
3. Wing size: 2"
4. Color: Same color as wall panels.

E. Mounting Method: Adhesive using manufacturer's recommended adhesive for the applicable substrate.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data and installation instructions.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.

3.3 SUBSTRATE PREPARATION

A. Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.

B. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.

C. Exterior walls must be adequately damp-proofed and insulated.

D. Drywall substrates should be paint ready.

3.4 PREPARATION

A. All surfaces must be free from dust and cleaned prior to installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the panels to detach.

B. Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.

C. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.

D. All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" oversize, then sealed with caulking.

E. Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" expansion gap should be created when installing panels around these pipes, then sealed with caulking.

F. All pipes, fixing bolts, etc. extending through the panels should have a minimum 1/8" expansion gap and be sealed with caulking.

G. If fitting to door frames, these must be in place prior to installation of panels.

H. Prior to installation, it is advisable to complete any painting which comes in contact with panels, as sealant used at junctions is non-paintable.

I. Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.

J. The panels must be stored on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.

K. First, check the room using a 6' level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.5 INSTALLATION

A. Stainless Steel and Aluminum Wall System Installation: Install wall systems in accordance with the current published manufacturer's Installation Guide.

3.6 CLEANING

A. Wall panels can be cleaned with a diluted soap/detergent solution.

B. To reduce the buildup of static, cleaning the panels with an anti-static solution is recommended.

END OF SECTION

SECTION 102813 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Extent of each type of toilet accessory is indicated on drawings.

B. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

C. Accessories may be used in locations other than toilet rooms, i.e. lounges, janitor rooms, etc.

D. The contractor shall provide solid blocking for accessories at all locations. See also Division 06 Section “Rough Carpentry.”

E. Types of toilet accessories required include the following:

1. Soap dispenser (OFCI).
2. Paper towel dispenser (OFCI).
3. Electric hand dryer (OFCI)
4. Mirror.
5. Semi-recessed toilet tissue dispenser.
6. Toilet seat cover dispenser (OFCI).
7. Toilet room grab bars.
8. Hand sanitizer dispenser (OFCI)
9. Single robe hook.
10. Mop & broom holder.
11. Utility shelving.
12. Glove dispenser (OFCI)
13. Sharps container (OFCI)
14. Shower enclosure.
15. Shower Curtain and Shower Rod.

1.3 DEFINITIONS

A. “OFCI” is the abbreviation for “Owner Furnished, Contractor Installed.”

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.

2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.5 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

C. Coordinate blocking requirements prior to installation.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.

2.2 ACCEPTABLE MANUFACTURERS

A. Basis of Design Product Standard Accessories: The design for the toilet accessories is based on “Bobrick Washroom Equipment, Inc.” Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

1. Bradley Corporation.

B. Basis of Design Product Ligature Resistant Accessories: The design for the toilet accessories is based on Whitehall Manufacturing. Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

1. Kingsway Group.

C. Basis of Design Product Shower Enclosure: The design for the shower enclosure is based on CDX Comfort Designs. Subject to compliance with requirements, provide the named product or a comparable product by one of the following or approved:

1. Kohler

2.3 STANDARD ACCESSORIES

A. Soap Dispenser: OFCI.

B. Paper Towel Dispenser: OFCI

C. Mirror: Bobrick #B-290. One-piece, roll-formed 3⁄4" x 3⁄4" (19 x 19mm) angle-frame. Type 304 stainless steel angle with satin finish. Corners heliarc welded, ground and polished smooth. Beveled frame edge at mirror. No. 1 quality, 1⁄4" (6mm) glass mirror with galvanized steel back. Provide with integral shelf, 5 inches deep at staff toilet rooms. See Drawings for size, or 24" x 36" typical unless noted otherwise on Drawings.

D. Semi-Recessed Toilet Tissue Dispenser: Bobrick B-4388

E. Toilet Seat Cover Dispenser: Bobrick B-221

F. Toilet Room Grab Bars: Provide Bobrick Series #B-6806, or approved, Type 304 stainless steel 1-1/2" o.d. grab bars in toilet rooms, of lengths and mounting conditions as required for wall construction on which they are mounted, and of shapes and types shown on Drawings. Concealed mounting.

G. Single Robe Hook: Bobrick #B-671. Bright polished stainless steel.

H. Mop & Broom Holder: Bobrick #B-223 x 24. Stainless steel with satin finish. Provide one in each custodial room.

I. Wall-Mounted Utility Shelving: Knape & Vogt Series 85/185 heavy duty shelf standards and brackets. Provide at each custodial room. Brackets 185 Series, 16 inch length. Standards 85 Series, double slot, 48 inch length, maximum spacing 16” (three minimum per 36” long shelf). 36” Width or as indicated. Shelves to be 3/4” x 16” x length indicated, plywood with white plastic laminate overlay and rounded front edge. Provide (3) shelves at each location unless otherwise indicated.

J. Shower Enclosure: Comfort Designs Model XS1363BFSD including grab bars, fold-up seat, hand-held shower assembly with slide bar, pressure balancing mixing valve, soap dish.

K. Shower Curtain: Bobrick #204-3. Vinyl shower curtain, opaque, matte white .008 inches thick. Nickel plated brass grommets at 6 inches o.c. Bottom and sides hemmed. 70 inches wide x 72 inches high. Include number of spring lock stainless steel wire hooks as required for grommets.

L. Shower Curtain Rod: Bobrick #B-6047. 18 gauge Type 304 stainless steel, satin finish. 1-1/4 inches diameter 2-1/2 inches square, Type 304 stainless steel, satin finish flanges. 60" long (±); verify.

2.4 LIGATURE RESISTANT ACCESSORIES (WC Room 103 and WC Room 202)

A. Soap Dispenser: OFCI

B. Electric Hand Dryer: OFCI (American Specialties, Inc. Model #0198-MH)

C. Mirror: Whitehall Model WH 1815

D. Semi-Recessed Toilet Tissue Dispenser: Whitehall Model WH 1845B

E. Toilet Room Grab Bars: Whitehall WH 1110

2.5 FABRICATION

A. General: Only an unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Where toilet accessories overlap upper edge of wainscot, provide plywood spacer of thickness equal to wainscot thickness. Plywood to have hardwood edge band and shall be recessed from edge of accessory 3/8" on all exposed perimeter edges.

C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102813

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Fire extinguisher mounting brackets.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.

B. Coordination: Verify that cabinets are sized to accommodate type and capacity of extinguishers indicated and provided by Owner under separate Contract.

C. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating and classification of extinguisher.

D. FM-Listed Products: Fire extinguishers approved by Factory Mutual Research Corporation for type, rating and classification of extinguisher with FM marking.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. J.L. Industries Inc., a division of Activar Construction Products Group.
2. Larsen's Manufacturing Co.
3. Modern Metal Products.
4. Potter-Roemer, LLC.
5. Samson Products.

2.2 FIRE EXTINGUISHERS

A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.

1. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2:10 A:B, 10 lbs., nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
2. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage.

B. Mounting: Coordinate blocking locations prior to installation.

1. Public Area Mounting: Cabinet mounted.
2. Service Area Mounting: Metal brackets.

C. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by the same manufacturers as extinguishers.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2.4 CABINETS

A. Construction: Manufacturer's standard box, with trim, frame, door and hardware to suit cabinet type, trim style and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Typical non-rated cabinets as per this specification.
2. Construct fire rated cabinets with double walls lined with minimum 5/8 inch thick, fire barrier material. Provide factory drilled mounting holes. Location as indicated on drawings.

B. Cabinet Type: Suitable for containing the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions. See drawings for locations at each type:

1. Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth.

D. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

a. Rolled-edge trim with 2-1/2-inch backbend depth.
b. Trim Metal: Of same metal and finish as door.

E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Materials:

a. Trim: Exposed.
b. Doors: Aluminum, clear anodized finish with brushed satin finish.
c. Door Style: Safety glass panel.
d. Finish: No. 180 Clear Anodized

F. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing and location.

1. Application Process: Silk screen.

G. Door Style: Manufacturer's standard design.

1. Duo Panel: Clear tempered float glass, 3/16 inch thick.

a. Silk-screen lettering or design.

H. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 deg.

2.5 STEEL CABINET FINISHES

A. Surface Preparation: Solvent-clean surfaces complying with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).

B. Baked-Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range for color and gloss. Paint the following:

a. Exterior of cabinet, except for those surfaces indicated to receive another finish.
b. Interior of cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.
B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Follow manufacturer's printed instructions for installation.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.

1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
2. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION 104400

SECTION 105120 – PHENOLIC CORE LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Phenolic core lockers to be located as indicated on the Drawings.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for concealed wood support base, furring, blocking, and shims required for installing lockers and concealed within other construction before locker installation.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show base, sloping tops, filler panels and other accessories.
2. Include locker identification system.

C. Color samples on 12 inch squares of same plastic laminate to be used for exposed surfaces of lockers.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain lockers and accessories through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support lockers before they are enclosed.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that lockers can be supported and installed as indicated.

1.8 PROJECT CLOSEOUT

A. Warranty:

1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

a. Failures include, but are not limited to, the following:

1) Structural failures.
2) Faulty operation of latches and other door hardware.

b. Damage from deliberate destruction and vandalism is excluded.
c. Warranty Period for Phenolic Core Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PHENOLIC CORE LOCKERS

A. Manufacturer and Style:

1. Basis of Design Manufacturer: ASI Storage Solutions, Traditional Plus. Subject to compliance with requirements, phenolic lockers may also be provided by one of the following manufacturers

a. Brikley
b. Hollman
c. All Partitions
d. Columbia Lockers (Addendum 1)

B. Locker Arrangement:

1. Provide two-tier 72” H x 12"W x 15"D.

C. Materials: Solid phenolic cores with plastic laminate faces with multiple resin-impregnated kraft and surface sheets fused at high temperature and pressure.

1. Doors, Tops, Bottoms, Shelves and End Covers: 1/2" solid phenolic core with plastic laminate face.
2. Side and Back Panels: 3/8" solid phenolic core with plastic laminate face.

D. Construction: Basis of Design manufacturer’s standard construction

1. Doors shall be fitted with recessed handle, number plate, padlock hasp, and optional locking device. Perimeter ventilation. Doors shall be mounted to side panel using powder coated steel piano-type hinges and machined fasteners. Door edges shall be smooth and chamfered with corners radiused.
2. Side Panels shall be attached to all Tops, Bottoms, and Shelves, using rust-resistant and steel fasteners. Exposed edges shall be smooth and chamfered.
3. Tops, Bottoms, and Shelves shall be attached to all Side Panels, using rust-resistant and steel fasteners. Exposed edges shall be smooth and chamfered.

E. Hardware: Basis of Design manufacturer’s standard construction

1. Doors: All hinges shall be power coated steel, 120 degree limited swing. Door latches shall be mounted at the midpoint of each door. Hasps shall be mounted below each handle and will accept standard padlock styles.
2. Fasteners shall be of rust resistant door hinges and latches, and handles will be mounted with rivets and/or machine screws. Hooks and number plates will be mounted with rivets.
3. End Cover Panels shall be mounted with stainless steel barrel screws.
4. Locker units banked together to be joined with stainless steel barrel screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c.
2. Identification Plates: Attach plates in each locker door with at least two aluminum rivets.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

C. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 105626 - MOBILE STORAGE SHELVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mechanically assisted systems.
2. Powered systems.
3. Steel-bracket shelving.
4. Slab sawing and preparation for recessed rails.

B. Related Requirements:

1. Division 03 Section "Hydraulic Cement Underlayment" for leveling of floor where recessed tracks are installed.
2. Division 26 Sections for power connections.

1.3 COORDINATION

A. Recessed Tracks: Coordinate size and location of recessed rails and structural engineer’s recommendation for anchorage with approved shop drawings. Coordinate slab preparation with schedule to occur before final finishes are installed.

B. Powered systems: Coordinate connections with electrical subcontractor.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include mobile operation, construction details, material descriptions, dimensions of individual components and profiles, and finishes for mobile storage shelving systems and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Show shelving layout.
3. Show location and extent of rail system including depth required if recessed.
4. Show clear-aisle widths from face of carriages.

5. Detail fabrication and installation of mobile shelving systems including methods of anchoring shelves to carriages and rails to building structure as required for seismic restraint.
6. Include preliminary seismic up-lift calculation with initial bid.
7. Include diagrams for power and control wiring.
8. Include methods of connection for motors and controls and location of electrical rough-in.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Delegated-Design Submittal: For mobile storage shelving, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Seismic Design Calculations: For seismic design of mobile storage shelving systems including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

a. Include seismic anchorage of rails and shelving analysis. Articulating flue spacers to be used where back to back carriages are specified as they will allow movement of rack while transferring loads across uneven floors. Rigid flue spacers will not be allowed.
b. On back-to-back configurations, individual wheel assemblies must be connected with an articulated carriage base/rack flue spacers in order to have the system track and transfer the rack loading equally to all carriage wheels.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mobile shelving systems and operating manuals to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating mobile storage shelving that meets or exceeds performance requirements indicated and of documenting this performance by test reports, and calculations.

1. Manufacturer of electric mobile systems must have a minimum of 35 years' experience in the continuous manufacture of electrically operated mobile systems.
2. Manufacturer must be ISO 9001:2008 certified.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of support rail anchors, embedded conduit, and other construction contiguous with mobile storage shelving by field measurements before fabrication.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of mobile shelving systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal wear.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain mobile storage systems including shelving from single manufacturer.

B. Basis-of-Design Products: The design for Mobile Storage Shelving is based on Spacesaver ActiveRAC systems.

1. Mechanically activated systems: Spacesaver ActivRAC 7M.
2. Powered systems: Spacesaver ActivRAC 16P

C. Products by a manufacturer other than the Basis-of-Design product will be considered only upon prior approval of a pre-bid substitution request made in compliance with Division 01 Section “Product Substitutions and Options.” Substitution requests must be accompanied by sufficient detailed documentation to allow the Architect to make a determination that the proposed product provides an equivalent system to the Basis-of-Design product. No post-bid substitutions will be allowed.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated-Design Submittal: For mobile storage shelving, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Seismic Performance: Mobile shelving systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Structural Performance: Provide mobile shelving systems capable of supporting the following:

1. Load per Linear Foot of Carriage: 1000 lb/ft.
2. Total Load: 7,000 lbs per carriage wheel and 16,000 lbs per carriage section.

D. Operating Force: For manually operated systems, maximum 1 lbf required to move 4000 lb.

2.3 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard mobile storage shelving systems and components. Where components are not otherwise indicated, provide manufacturer's standard components as required for a complete system.

B. Fasteners: Furnish required concrete bolts and similar anchorage devices for installing track system, and furnish other components of work where installation of devices is specified in another Section.

C. Tracks: Steel rails with tops machined to mate with guide wheels and with ends designed to provide smooth, secure continuity between sections without field welding. Provide mounting brackets, anchorage devices, adjustable leveling devices, and stops at terminations of rails to prevent carriages from running off track ends.

1. Mounting: Recessed.

D. Carriages: Rigid frames consisting of C-shaped cold-formed steel beams and cross beams, designed to allow secure anchorage of shelving units.

1. Carriage Width: Nominal 3 feet to 4 feet as shown on drawings.
2. Carriage Length: Nominal 5 feet to 8 feet as shown on drawings
3. Wheels: Manufacturer's standard number of bearing-mounted, steel wheels, precision ground to mate with tracks.
4. Bumpers: Provide two rubber bumpers with minimum depth of 1/2 inch each side.

E. Anti-Tip Brackets: Mount on carriage for engagement with track system to secure units against tipping.

2.4 MECHANICALLY ASSISTED SYSTEMS

A. Drive Systems: Geared transmission and chain systems with tensioning device to provide mechanical assistance and uniform movement along entire length of each carriage. Permanently shielded and lubricated.

B. Drive Shaft: Continuous tubular or solid steel shaft, capable of transmitting torque from drive system without distortion.

C. Locking Pins: Located on range end panels to allow locking of individual range carriage when depressed.

2.5 POWERED SYSTEMS

A. Motors: UL-listed, DC voltage, geared, in-line motor for connection to 115-V ac power source. Size as required for loads indicated.

B. Drive Shaft: Continuous tubular or solid steel shaft, capable of transmitting torque from motor without distortion.

C. Control System: Manufacturer's standard operation system to automatically open aisles at selected locations with controlled acceleration and deceleration of carriages. Provide single controls centrally mounted on end panels.

D. Safety Devices: Manufacturer's standard safety devices as required to stop carriage motion. Provide the following:

1. Emergency Stop Button: Momentary contact, red push-button switch to immediately stop carriage motion. Provide sign or lettering on button indicating "Emergency Stop/Reset."
2. Safety Sweep: Hinged safety bar consisting of an impact-pressure-activated, internal-contact switch plate mounted along full length of each carriage at bottom edge. Maximum 1 lbf results in immediate stop of carriage motion.
3. Aisle-Length Presence Detector: Pulsed infrared, sender-receiver assembly operating along length of open aisle that prevents motion in adjacent carriages while aisle is occupied.
4. Aisle Entry Presence Detector: Pulsed infrared, sender-receiver assembly at entry to open aisle that stops motion in adjacent carriages when aisle is entered and prevents motion while aisle is occupied.

2.6 ~~STEEL FOUR-POST SHELVING~~ *WIDE SPAN SHELVING & PALLET RACK SHELVING (Addendum 2)*

A. ~~Steel Four-Post Shelving: Shelving consisting of four angle-iron uprights per section, with adjustable shelves resting on shelf supports hung on uprights. Configure units for mounting on mobile carriages~~. *(Addendum 2)*

B. Shelving Units

1. Type: Self-supporting unit.
2. Configuration: Open.
3. Shelf Styles: Provide the following styles and numbers of adjustable shelves:

a. Central Services *CS Storage B30* ~~B122~~: *Wide span Shelving with* wire shelves, 24 inches deep, 3 shelves high. *Minimum 1,000 lbs per shelf level. (Addendum 1)*
b. Commissary *Shelving Storage 153* ~~*167*~~: *Wide span Shelving* with wire shelves, 18 inches deep, 4 shelves high. *1,000 lbs per shelf level. (Addendum 1)*
c. Commissary *Pallet Storage 156* ~~*166*~~: 3-Tier pallet system. *4,000 lbs per level. (Addendum 1)*

~~C. Uprights: Double-wall steel posts, 2 inches wide, 0.048 inch thick, in manufacturer's standard T-shape for common-post use or L-shape at range ends, with keyhole perforations on the inner wall at 1-1/2 inches o.c.~~ *(Addendum 2)*

~~D. Steel Spacers: Provide 0.048-inch- thick steel spacers, 3 inches high, welded to posts at bottom, center, and top of open units to prevent deflection.~~ *(Addendum 2)*

E. Base: Manufacturer's standard for attachment to mobile carriages.

F. Sourcing: By same vendor as mobile carriages. (Addendum 2)

2.7 STEEL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, minimum recess depth, and other conditions affecting performance of mobile shelving systems.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SLAB PREPARATION

A. Provide appropriate containment measures to prevent concrete dust from migrating outside the work area.

B. Saw cut concrete slab to sufficient depth and width to accommodate rail installation.

C. Install grout to fill overcuts.

3.3 INSTALLATION

A. Level and plumb tracks to a tolerance of 0.09 inch in 120 inches with no more than 0.06-inch variation between adjacent rails. Use permanent shims or non-shrink grout as indicated by manufacturer.

B. Recessed Track Systems: Solidly fill gaps between slab and rail according to manufacturer's written instructions to secure tracks and prevent movement.

C. Carriage Installation: Mount mobile carriages on track system with anti-tip brackets engaged by rails and adjust for smooth operation. Provide non-moving carriages where indicated securely fixed to rails.

3.4 SHELVING INSTALLATION

A. Attach shelving units to carriages according to manufacturer's written instructions and as required to prevent vibration during movement.

1. Level and plumb shelving units to a tolerance of 1/8 inch in 96 inches.

B. Install shelves in shelving units at locations indicated on Drawings and according to manufacturer's written instructions.

3.5 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protect installed products from damage during remainder of the construction period.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mobile storage shelving.

END OF SECTION 105626

SECTION 108000 – MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. The following items are included in this section:

1. Key box.

2. Shelf standards and brackets.

3. Baby changing table.

B. Related Sections include the following:

1. Division 06 Section “Rough Carpentry” for blocking and backing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 KEY BOX (Knox Box)

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved:

1. Basis of Design Product: Series 3200, recessed key box as manufactured by The Knox Company.

B. Keying for key box shall match local Fire District key. Provide no keys with units.

C. Install key box at location as shown or directed.

2.2 SHELF STANDARDS AND BRACKETS

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved:

1. Basis of Design Product: KV Shelving

B. Shelving configuration: 8 inch deep adjustable wall mounted chrome wire shelves, including 8 inch deep double wire shelf brackets and 14 inch wall mounted post kits. Shelves to adjust on 1" centers.

C. Refer to drawings for locations and layout. Provide backing at each standard.

2.3 BABY CHANGING TABLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved:

1. Basis of Design Product: Koala Kare Products, Inc. Model KB100-ST:

B. Mounting: Recessed-mounted, horizontal design.

C. Color: As selected by Architect from manufacturer's full range.

D. Refer to drawings for locations and layout. Provide backing at all mounting points.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

END OF SECTION 108000

dj/July 18, 2017

SECTION 110140 – INDUSTRIAL SAFETY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section Includes: Rooftop fall arrest and fall restraint anchors. System to be designed and installed by Bidder. See following article “Qualifications.”

1.3 DESIGN AND SPECIFICATION CONSIDERATIONS

A. Fall restraint and fall arrest systems as required to meet WISHA regulations for Owner’s employees working on roofs.

B. Attachment of anchors requires transfer of loads into building structural framing. Systems that only bolt into roof deck without transferring load are not accepted.

C. Employees using systems are required by Washington State Department of Labor and Industries (L & I) Washington Industrial and Health Safety Act (WISHA) WAC 296-155-24505 to receive documented training in use of fall restraint and fall arrest systems.

1.4 REFERENCES

A. Reference Standards: Current edition at date of Bid.

B. Washington State Department of Labor and Industries WISHA Chapter 296-155 WAC Part C-1 Fall Restraint and Fall Arrest.

C. Occupational and Safety Health Administration (OSHA) Standards:

1. OSHA Rule on Fall Protection in General Industry (29 CFR 1910 Subpart I).
2. OSHA Rule on Safety Standards for Fall Protection in the Construction Industry, (29 CFR 1910 and 1926, Subpart IV).

D. ANSI Z359.1 - Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components.

E. ANSI A10.14 - Requirements for Safety Belts, Harnesses, Lanyards, and Lifelines for Construction and Demolition Use.

F. American Society for Testing and Materials (ASTM):

1. ASTM A 53 - Standard Specification for Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A 123- Standard Specification for Zinc (Hot-Dipped) Galvanized Coatings on Iron and Steel Products.
3. ASTM B 221 - Specification for Aluminum and Aluminum Alloy Extruded Bars, Rod, Wire, Shapes, and Tubes.

G. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code -Steel.
2. AWS D1.2 - Structural Welding Code -Aluminum.

1.5 DESIGN REQUIREMENTS

A. Conform to WISHA for fall arrest and fall restraint systems.

B. Fall Arrest and Fall Restraint Anchors: Permit free movement of persons over entire roof while attached by full body harness, retractable life line, and vertical life line attached to D-ring or eye at each fall arrest anchor using quick release attachments.

C. Upright Anchors: As instructed by manufacture in layout and design acceptable to Architect.

D. Pullout Force: Design fall arrest anchors and connections to resist 5,000 pound pullout force without failure.

E. Arrest Force: Limit to 1,800 pound or less.

F. Free Fall Distance: Limit to 6 foot.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings:

1. Show rooftop locations of fall arrest anchors, configurations, dimensions, attachment details, and components required for complete fall arrest system conforming to provisions of this Section.
2. Show interfacement with adjacent materials.
3. Bear seal and signature of professional structural or civil engineer, employed by manufacturer, licensed in State of Washington, responsible for design.

C. Product Data: Descriptive product literature with relevant data highlighted. Include physical characteristics, performance data, and limitations.

D. Structural Calculations:

1. Design to safety factor conforming to WISHA for structural connections and components.
2. Design connections and reinforcement as required to resist specified pull out and arrest forces.

3. Bear seal and signature of structural or civil engineer, employed by manufacturer, licensed in State of Washington, responsible for design of anchors and attachments.

E. Manufacturer's Instructions: Include Installation Instructions, special procedures, and conditions requiring special attention.

F. Certification: Written statement signed by manufacturer's authorized representative. Certify that fall arrest system complies with provisions of this Section, including:

1. System: Engineered and designed to accommodate roof deck, roofing type, structural requirements, and watertight seal at roofing system.
2. Installer: Certified as authorized by manufacturer.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Drawings: Submit under provisions of Division 01, Section "Project Closeout." Show location of each fall arrest anchor as installed.

B. Submit two (2) copies of Plexiglas mounted roof plan drawing, for posting near roof access points, showing anchor locations and details.

C. Maintenance and Operating Data: Submit under provisions of Division 01, Section "Project Closeout." Include manufacturer's maintenance procedures, safety inspection log book for yearly inspections.

1.8 QUALIFICATIONS

A. Manufacturer:

1. Company specializing in work of this Section with minimum 5 years documented experience.
2. Employing complete engineering and technical personnel needed to engineer, design, and perform work of this Section.

B. Installer:

1. Manufacturer or certified by manufacturer as qualified to perform work of this Section.
2. Able to document minimum 3 years' experience in successful installations of manufacturer's fall arrest and fall restraint systems.

1.9 REGULATORY REQUIREMENTS

A. Conform to Washington State Department of Labor and Industries WISHA Chapter 296-155 WAC Part C-1 Fall Restraint and Fall Arrest.

B. Conform to additional requirements of OSHA - Occupational and Safety Health Administration Standards, except where in conflict with adopted WISHA regulations.

C. Welding: Conform to Division 5. Perform welding by welding operators currently certified by WABO.

1.10 PRE-INSTALLATION CONFERENCE

A. Arrange between Contractor, Roofing and Deck Subcontractors, Owner, Owner's roofing maintenance supervisor, Architect, manufacturer's representative, and others as requested to attend.

B. Meet within time period needed to coordinate work of related Sections with work of this Section.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Conform to manufacturer's instructions.

1.12 COORDINATION

A. Conform to Division 01, Section "Project Coordination" for coordination with work of other Sections.

PART 2 - PRODUCTS

2.1 POST TYPE FALL PROTECTION ANCHOR SYSTEMS

A. Manufacturer:

1. Guardian: Tel: 800-466-6385, www.guardianfall.com.
2. Summit Anchor Company: Tel: 800-372-1098, www.summitanchor.com.

B. Basis of Design Product: Guardian Fall Protection; CB 18 Series Roof Anchor, welded to structural support.

2.2 FABRICATION

A. Fabricate engineered fall restraint and fall arrest system suitable for roof and structure mounting with welded steel base plate and steel plate uprights or steel pipe uprights.

2.3 FINISHES

A. Steel Pipe Uprights, Base Plates, D-Rings, Cables, and Clamps: Stainless steel, spun aluminum, or carbon steel hot-dip galvanized after fabrication. Galvanize carbon steel to following standards:

1. Pipe: ASTM A 53.
2. Plate: ASTM A 123.
3. D-Rings: ASTM A 123 or ASTM A 153.
4. Galvanizing Repair Compound: 95 percent zinc cold galvanizing compound, as specified Division 05, Section "Metal Fabrications."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions as satisfactory to receive work of this Section. Do no work until correction of unsatisfactory conditions. Beginning work constitutes acceptance of existing conditions.

B. Verify layout of roof fall arrest anchors and structural connections suitable for work of this Section.

3.2 INSTALLATION

A. Install fall arrest system in accordance with manufacturer's instructions and provisions of Contract Documents. Where in conflict verify with Architect before beginning work.

B. Lay out fall arrest system according to Architect accepted shop drawings.

C. Isolate dissimilar metals to prevent contact.

3.3 ADJUSTING

A. Repair or replace defective installations not conforming to provisions of Contract Documents.

B. Field touch up damaged galvanizing surface finishes with galvanized finish with galvanizing repair compound.

END OF SECTION 110140

SECTION 11 08 00 – COMMISSIONING OF EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. System specific commissioning procedures

B. Related Sections:

a. The following sections specify commissioning activities for this project:

01 91 13 – General Commissioning Requirements

b. All sections related to the following commissioned systems may contain start-up, testing and/or commissioning related activities:

Walk-in cold storage rooms

1.2 DESCRIPTION OF WORK

A. Work includes the completion and documentation of formal commissioning procedures by the Contractor on selected equipment and systems as listed under 1.1 B. Commissioning is defined as the process of verifying and documenting that the installation and performance of selected building systems meet the specified design criteria and therefore satisfies the design intent and the Owner's operational needs. The Contractor shall be responsible for participation in the commissioning process as outlined herein, and in subsequent sectional references and attachments throughout the project documents. Commissioning procedures shall be designed and conducted under the direction of the Commissioning Authority (CxA) and coordinated by the Contractor Commissioning Coordinator (CCC).

B. This section contains the system specific commissioning requirements for the systems referenced herein.

PART 2 – PRODUCTS

2.1 Documentation requirements for the systems to be commissioned are specified in Section 01 91 13, Part 2 – Products.

PART 3 – EXECUTION

3.1 Execution of the commissioning process for the systems to be commissioned is specified Section 01 91 13, Part 3 – Execution.

SCHEDULE A – Start-up Plan , Contractor Checklists and Document Tracking

A Startup Plan shall be developed as outlined in Section 01 91 13. The Startup Plan shall include manufacturer's startup procedures and Contractor Checklists (CCL) as provided by the CxA.

Sample CCLs are included in this Schedule. The Contractor responsible for delivery of the equipment and appurtenances associated with the systems listed in Table – A shall be responsible for completion of the CCL for each individual piece of equipment in the system group. The CCLs included within this Schedule are sample versions and are representative of what will be included in the final Commissioning Plan.

The Contractor is responsible to demonstrate the proper operation of all installed systems and the final CCLs shall contain the requirements to document these demonstrations. In no case shall the checklists require performance criteria more stringent than specified by the Project Documents.

The CCC is responsible for collecting the completed CCLs and start-up documents and maintaining the Startup Plan during installation and startup activities. The CCC shall review the material for completeness, then sign off on the CCLs as an indication that documents are complete. Once all CCLs and start-up documents are received, they shall be turned over to the CxA.

The following Table - A identifies the CCLs and related documents that will be included in the final Startup Plan. Listed as subcategories below each system are the documents that shall be required to be submitted as part of the system startup activities. This documentation includes installation, startup, static tests, pressure tests, cleaning, flushing, disinfecting, certifications and other miscellaneous checklists. This table shall be used as a document tracking mechanism by the CxA, CCC and Contractor for the process of submittal, review and approval of installation and startup documents and CCLs. The table shall be included in the Startup Plan, which is a subset of the Commissioning Plan.

Table-A Key:

A. System description for each system commissioned. A Contractor Checklist is included for each commissioned system. The subcategories include required documentation to be submitted with the CCL.
B. Contractor responsible for installation, startup, testing and submittal of documents for commissioned system. To be filled in after contract award.
C. Date the proposed documents are received by the CxA from the responsible Contractor. NOTE: These documents shall include, but are not limited to, procedures and forms to include such activities as: manufacturer's installation and start-up, pressure testing, TAB, cleaning, flushing and disinfection. The CCL is provided by the CxA.
D. Indicates that CxA has received and approved proposed installation and start-up documentation.
E. Date the completed documents are received by the CxA from the responsible Contractor.
F. Indicates that CxA has received and approved completed documentation.
G. Notes on status of forms, irregularities and rework needed

Table - A: System Summary and Documentation Tracking

A	B	C	D	E	F	G
System Description / Documents Required	**Responsible Contractor**	**Proposed Document Received**	**OK**	**Completed Document Received**	**OK**	**Notes**
Walk-in Freezer/Refrigerator						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				
Kitchen Hood Systems						
Manufacturer Start-up Documentation						
Contractor Checklist		CxA Provided				

SAMPLE
Walk-In Cold Storage Room
Contractor Checklist

Location: **Area/Room Served:**
Manufacturer: **Model:**

Check	RC	CxA	Note
Walk-In Box			
Area is cleaned and clear of construction debris.			
Equipment is clean and has no visible physical damage.			
Latches and hinges installed and operational.			
Condition of door seals.			
Door heaters installed and connected to power.			
Evaporator Unit			
Equipment is clean and has no visible physical damage.			
Manufacturer's required maintenance clearance provided.			
Mounted per project documents and installation instructions.			
Refrigerant piping and insulation installed.			
Condensate drain installed with cleanout.			
Condensate drain is insulated.			
Condensate drain heat trace installed.			
Nameplate Minimum Circuit Ampacity (Amp)			
Nameplate Maximum Overcurrent Protection Device (Amps)			
Installed overload.			
Overloads and/or fusing is appropriate.			
Control wiring and devices are installed.			
Supply power is installed and disconnect is accessible.			
Disconnect is labeled.			
Convenience outlet within 50’ of equipment.			
Condensing Unit			
Equipment is clean and has no visible physical damage.			
Manufacturer's required maintenance clearance provided.			
Mounted per project documents and installation instructions.			
Equipment labels are installed per project documents.			
Refrigerant piping and insulation installed.			
Control wiring and devices are installed.			
Supply power is installed and disconnect is accessible.			
Disconnect is labeled.			
Nameplate Minimum Circuit Ampacity (Amp)			
Nameplate Maximum Overcurrent Protection Device (Amps)			
Installed overload.			
Overloads and/or fusing is appropriate. (135% of FLA +next standard size)			
Convenience outlet within 50’ of equipment.			
Control Devices			
Tamper devices are installed and connected to fire alarm system			
Fire flow devices are installed and connected to fire alarm system			

Start-Up			
Refrigeration piping cleaned, leak checked, evacuated then charged with refrigerant.			
Motor operation and rotation verified.			
Compressor operation and cooling verified.			
Internal controls and safeties verified operational.			
External controls verified operational			
Start-up documentation submitted to CxA.			
Readiness			
System is ready for functional performance testing			
Representative photograph provided			

Sign-Off:

Team Member	Name	Date
Responsible Contractor (RC):		
Commissioning Authority (CxA):		

Notes:

SCHEDULE B – Functional Performance Tests

Functional Performance Tests

1 The preliminary versions of the Functional Performance Test and Verification Outline sheets contained in this Schedule define the individual systems to be tested and Contractor responsibilities based on the specific method of commissioning. These preliminary Functional Performance Test and Verification Outline sheets represent information available at the time of commissioning specification development. The final versions may be somewhat different and will be included within the Commissioning Plan as presented at the initial commissioning coordination meeting.

2 The methods of functional performance test and verification are listed in Table 1 of this Schedule. The Contractor will be responsible for supporting the testing activity as indicated. This may include developing the test plan and functional performance test forms for approval by the Commissioning Authority, performing testing to be witnessed by the CxA or providing support during functional performance testing conducted by the CxA or their sub-Authority.

3 Contract documents state that the Contractor is responsible to demonstrate that all systems comply with contract requirements and meet the project design intent. The scope of testing outlined in the following Functional Performance Test and Verification Outline sheets in this Schedule represent the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. If systems fail the initial tests additional testing may be required.

4 The following Test Summary Table identifies the functional tests that will be conducted on this project. This table will be used as a document tracking mechanism for the process of submittal and review of contractor provided testing documentation.

5 The contractor is responsible for submitting proposed functional test documentation to the Commissioning Authority for review and approval at least one month prior to these activities. It is the Contractor's responsibility to notify the Commissioning Authority in advance of the scheduled activity, testing or startup date. A minimum of 5 working days advance notification is required. If the CxA is not notified in advance of a scheduled start-up or testing activity, the start-up or testing shall be rescheduled and repeated to the satisfaction of the CxA.

6 The "Responsible Contractor" column of the table will be completed during the Initial Commissioning Coordination Meeting by assigning an individual Contractor responsible for the activities associated with each system based on what contractor provided that system.

Table – B: Functional Test Summary Table

A	B	C	D	E	F	G
	Responsible Contractor	**Proposed Test Forms Received**	**OK**	**Testing Complete**	**OK**	**Notes**
Walk-in Freezer/Refrigerator						
Kitchen Hood Systems						

Summary Table Key:

A. System description for each system commissioned.
B. Contractor responsible for providing testing. To be filled in after contract award.
C. Date the proposed test forms are received by the CxA from the responsible Contractor (if applicable).
D. Indicates that CxA has received and approved the proposed test forms.
E. Date(s) testing was performed by contractor.
F. Indicates that Commissioning Authority has witnessed and approved the testing and received all completed test forms.
G. Notes on status of forms, irregularities and rework needed.

Table 1 – Functional Test and Verification Methods

The following applies regardless of test method.

The contractor shall support the CxA during testing or verification, including but not limited to: scheduling and sequencing and adequate time for testing, on-site support during testing, testing instruments and equipment, setting up trend logs, providing access to equipment (including lifts), providing access to control systems both on-site and remotely.

The CxA shall do one or a combination of the following to verify contractor testing:

1. The CxA shall witness all or portions of the tests during contractor testing.
2. The CxA shall re-conduct the functional tests on all or portions of the systems using the same test plan and data sheets.
3. The contractor shall be required to duplicate some of the testing by demonstrating a percentage of the system as selected and witnessed by the CxA.

If during the verification process inconsistencies are found that demonstrate that the functional testing conducted by the contractor was not properly executed, the CxA shall suspend verification and the contractor shall be required to correct the problems and re-conduct the entire functional test and verification for the system(s) in question. Excessive test failures shall be subject to the back-charging provisions in Section 01 91 13.

Test Method A – Contractor Written and Conducted with CxA Oversight

The test plan and test data sheets are developed by the contractor responsible for the system and submitted to the CxA for approval. These can be the system manufacturer's stock test forms if appropriate. The CxA shall assist contractor in development of test forms if requested to do so. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Test Method B – CxA Written and Conducted, Contractor Supports

The test plan and test data sheets are developed by the CxA. The CxA shall conduct the tests per the plan, document results and notify contractor of any issues found.

Test Method C – CxA Written, Contractor Conducts

The test plan and test data sheets are developed by the CxA. The CxA shall turn over the test plan and test data sheets to the contractor. The contractor shall conduct the tests on 100% of the equipment per the plan, document results and submit completed test forms to the CxA for review and approval.

Food Service Equipment
Functional Test and Verification Outline

The testing outlined below represents the minimum expected level of testing to be performed during commissioning. The contractor shall be required to conduct and document any tests as necessary to prove all systems comply with the design intent. Table 1 in Schedule-B details the various methods of accomplishing functional testing.

Testing:

Test Method	Plan & Data Sheets By:	Conducted By:	Demonstration Percentage	CxA Will Sample or Witness
A.1	Contractor	Contractor	N/A	100%

Functional Tests:

1) Walk-in Freezers/Refrigerator
   a) Demonstrate operation of all features.
   b) Demonstrate temperature control.
   c) Demonstrate BCS Interface/Alarms

2) Kitchen Hoods
   a) Demonstrate operation of all features.
   b) Demonstrate on/off control and any interlocks.
   c) Demonstrate building control system Interface.
   d) Demonstrate fire suppression operation and interfaces.

PART 4 - Sample Documents

4.1 Sample functional test procedures and data forms are provided in this section to demonstrate the rigor of the process, test procedures and documentation that will be required from the contractor. These forms and procedures will be amended, augmented and updated in the final commissioning plan based on the final project documents, addendums and submittal information. **This sample section does not contain all functional test procedures and data forms that are required to be executed by the contractor**. Schedule - B of Part 3 provides a full list of the functional tests that will be required to be executed by the contractor.

Sample Functional Test Procedure

Walk-in Coolers

UNIT:	C1	C2	C3	C4
Unit operating temperature				
Measured temperature				
DDC temperature				
Evaporator fans operational				
Condensing unit compressor and fans operational				
Lights verified operational				
Door sensors verified operational				
Condensate heat tape verified operational				
Tests complete.				
Performance is acceptable				
Overrides clear, set points returned to original				

Sign-Off:

Team Member	Print Name/Co.	Initial	Date
Installing Contractor:			
CxA:			

Comments:

Freezer/Cooler Alarms

1. Verify freezer and cooler are operating below high temperature alarm.
2. Simulate a temperature above the high temperature alarm by lowering the high temperature alarm set point.
3. Verify an alarm is generated.
4. Clear alarms and return set points to original setting.

	Freezer	**Cooler**
Pre-Test:		
Zone Temperature		
High Temperature Alarm set point		
Test:		
High Temperature Alarm set point lowered to:		
Alarm generated?		
Reset Ok?		
Issue		

☐ Tests are complete and performance is acceptable.

Sign-Off:

Team Member	**Print Name/Co.**	**Initial**	**Date**
Controls Contractor:			
CxA:			

Comments:

END OF SECTION 110800

SECTION 111313 - LOADING DOCK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Loading dock bumpers.
2. Loading dock seals.
3. Overhead door track protector.
4. Interior bollards

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 08 Section “Sectional Overhead Doors.”

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product Data: For each type of loading dock accessory.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section “Submittal Procedures” for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Loading Dock Supply, Inc.
2. Beacon Industries, Inc.
3. Blue Giant Equipment Corporation.
4. Kelley; 4Front Engineered Solutions, Inc.
5. Nova Technology International.
6. Pioneer Dock Equipment.

2.2 DOCK BUMPERS

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.

B. Extra Long Laminated-Tread Dock Bumper: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires.

1. Thickness: 4-1/2 inches .
2. Horizontal Style: 12 inches high by 113” width.
3. Basis of Design Product: Loading Dock Supply Model B4512-111-AD-T.

C. Materials: ASTM 36/A 36M for steel plates, shapes, and bars. Hot-dip galvanize according to ASTM A 123/A 123M.

2.3 DOCK SEALS

A. General: Surface-mounted vinyl seals at sides and top of loading dock opening, with pressure treated wood backing, high density foam core and wear shields.

B. Dock Seal: 8 inch deep x 12 inch wide x 10 foot tall sides with full length yellow guide strips. 8 inch deep x 24 inch high x 9 foot – 6 inch long header.

1. Basis of Design Product: Loading Dock Supply Model 40CS8C.

2.4 TRACK PROTECTORS

A. General: Steel floor/wall mounted guards to protect door tracks from damage.

B. Door Track Guards: 48-inch tall 3/16 inch steel track guards with chamfered top edge welded to 5/8 inch floor plate, wrap-around design with right and left hand styles, painted safety yellow enamel over gray primer coat.

1. Basis of Design Product: Loading Dock Supply Model DG48.

2.5 BOLLARDS

A. General: Floor mounted bollards located per drawings to protect shelving and equipment.

B. Interior Bollards: 6 inch I.D. schedule 40 pipe, 48 inches high, welded to 10” x 10” x 5/8 inch base plate painted safety yellow with a black plastic cap at the top.

1. Basis of Design Product: Loading Dock Supply Model SRB48-6

PART 3 - EXECUTION

3.1 INSTALLATION

A. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.
2. After completing installation of exposed, factory-finished dock bumpers, inspect exposed finishes and repair damaged finishes.

B. Dock Seals: Attach dock-seal support frames securely to building structure in proper relation to openings and dock bumpers to ensure compression of dock seals when trucks are positioned against dock bumpers.

1. Adjusting: After completing installation, inspect exposed factory finishes and repair damaged finishes.

C. Track Protectors and Interior Bollards: Coordinate locations to assure operational clearance for items being protected. Attach protectors and bollards by drilling and anchoring with expansion anchors and bolts.

END OF SECTION 111313

SECTION 114000 – FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES: Foodservice Equipment

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and Division 1 Specification Sections, apply to this Section.

1.2 RELATED WORK:

A. Rough-ins and Final Connections: Service lines from rough-in to point of final connections are provided by plumbing and electrical contractors.

B. Electrical: Wiring, conduit, fuses, breakers, final disconnects, junction boxes, and other required electrical apparatus not built-in or mounted on equipment are provided by electrical contractor.

C. Plumbing: Controls, regulators, valves, stops, traps, strainers, checks, grease traps, and fittings not mounted on/in equipment are provided by plumbing contractor.

D. Mechanical: Ductwork from above finished ceiling to building exhaust and supply fans, flue pipes, exhaust and supply fans for hoods, room ventilation, and air supply blowers are provided by mechanical contractor.

E. Miscellaneous

1. Provides backing plates or blocking in wall or ceiling partitions.
2. Provides fittings secured to structural ceiling to accommodate hangers.
3. Provides the forming of architectural enclosures, floor, wall openings or recesses for equipment.
4. Caulks and seals Cold Storage Room floor sections to building floor.
5. Finishes floors (masonry or poured-in-place) in cold storage rooms, concrete curbs and pads.

1.3 SYSTEM DESCRIPTION

A. Delegated Design: Design canopy hoods with fire protection system, walk-in cold storage rooms, and seismic restraint of equipment using performance requirements and design criteria per codes, including comprehensive engineering analysis by a qualified professional engineer licensed by the State in which the project resides.

B. Fabricated Equipment: Constructed to configuration, dimension, detail, and design as shown with materials and workmanship as specified.

C. Manufactured Equipment: Mass produced and referenced by manufacturer’s name and model number.

D. Each model number includes the code *H011 as a suffix. This code is known as the Specified Identification System. It is not to be removed by the bidders. Its purpose is to identify the Food Service Consultant to the vendors providing equipment in the event it is necessary to communicate questions, clarifications, and comments, from prior to bid award through the final purchase. It is to be used on all correspondence, including fax and e-mail, when communicating with manufacturer representatives and factories.

1.4 DEFINITIONS:

A. Furnish - Supply and deliver to Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. Install (set in place) - Work at Project Site, including actual unloading, unpacking, assembly, erecting, rigging, placing, anchoring, applying, finishing, curing, protecting, cleaning, and similar operations, ready for final utility connections by other Sections as appropriate.

C. Coordinate – Relay required information requested by other trades to ensure they are able to correctly perform their work related to the food service or laundry equipment installation.

D. Provide - Furnish and install complete, ready for intended use.

E. Kitchen Equipment Contractor (KEC) - All references to the Contractor in this Section 114000 shall refer to the Kitchen Equipment Contractor (KEC). Reference to any other Contractor shall be specific, such as General Contractor, Plumbing Contractor, Electrical Contractor, Architect, designated, etc.

1.5 LAWS, ORDINANCES AND STANDARDS:

A. STANDARDS: Except as otherwise indicated, comply with the following standards as applicable to the manufacture, fabrication, and installation of the work of this Section:

1. Air Conditioning and Refrigeration Institute (ARI): Comply with the applicable regulations and references of the latest edition of standards for remote refrigeration system(s), components, and installation.
2. American Gas Association (AGA): Comply with AGA standards for gas heated equipment and provide equipment with the AGA seal. Automatic safety pilots shall be provided on all equipment, where available. (Canadian Gas Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
3. American National Standards Institute (ANSI): Comply with ANSI Z21-Series standards for gas-burning equipment and provide labels indicating name of testing agency.
4. American National Standards Institute (ANSI): Comply with ANSI B57.1 for compressed gas cylinder connections and with applicable standards of the Compressed Gas Association for compressed gas piping.
5. American National Standards Institute (ANSI): Comply with ANSI A40.4 and A40.6 for water connection air gaps and vacuum breakers.
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE): Comply with the applicable regulations and the latest edition of standards for remote refrigeration system(s), components, and installation.
7. American Society of Mechanical Engineers (ASME): Comply with ASME Boiler Code requirements for steam generating and steam heated equipment and provide ASME inspection, stamp, and registration with National Board.

8. American Society for Testing and Materials (ASTM): Comply with ASTM C1036 for flat glass.
9. American Society for Testing and Materials (ASTM): Comply with ASTM C1048 for heat-treated flat glass – Kind HS, Kind FT coated and uncoated glass.
10. American Welding Society (AWS): Comply with AWS D1.1 structural welding code.
11. National Electric Code (NEC): Comply with NFPA Volume 5 for electrical wiring and devices included with food service equipment, ANSI C2 and C73, and applicable NEMA and NECA standards.
12. National Electrical Manufacturers Association (NEMA): Comply with NEMA LD3 for high-pressure decorative laminates.
13. National Fire Protection Association (NFPA): Comply with the applicable sections of the NFPA for exhaust hood, ventilators, duct and fan materials, hoods fire suppression systems, construction and installation, as well as local codes and standards.
14. National Sanitation Foundation (NSF): Comply with the latest Standards and Revisions established by NSF for equipment and installation. Provide NSF Seal of Approval on each applicable manufactured item and on items of custom fabricated work. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.)
15. Sheet Metal and Air Conditioning Kitchen Equipment Contractor (KEC)'s National Association (SMACNA): Comply with the latest edition of SMACNA guidelines for seismic restraint of kitchen equipment and applicable local regulatory agencies requirements.
16. Underwriters Laboratories (UL): Provide either UL labeled products for electrical components and assemblies or, where no labeling service is available, "recognized markings" to indicate listing in the UL "Recognized Component Index". (Canadian Standards Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
17. UL 300 Standard: Wet chemical fire suppression systems for exhaust hoods/ventilators shall comply with these requirements.
18. American with Disabilities Act (ADA): Comply with requirements as applicable to this Project.
19. Refrigeration Service Engineers Society (RSES): Comply with the applicable regulations, the latest edition of standards for remote refrigeration system(s), components and installation, and the 1995 requirements of the Montreal Protocol Agreement.
20. All refrigerants used for any purpose shall comply with the 1995 requirements of the Montreal Protocol Agreement and subsequent revisions and amendments. No CFC refrigerants shall be allowed on this Project.
21. All refrigeration components installation, repairs, and/or associated work on any refrigeration system, self-contained or remote, shall be performed by a Certified Refrigeration Mechanic.
22. Comply with all applicable local codes, standards and regulations, and any special local conditions (example only: City of Los Angeles Testing Lab requirements or seismic standards compliance).
23. Jails, prisons, and all detention facilities shall comply with Correctional Standards as applicable to the specific Project. Verify the level of security and construction required with the Project Architect and provide all items in compliance. As a minimum, no part or component of any item provided shall be easily removable and used as a weapon.
24. Subway grating installed in floor drain troughs must meet IBC 1104.3.1 standards for maximum opening sizes in grates.
25. Confirm all drawings, specifications, and project documentation meet all federal, state, and local codes and regulations.

1.6 KITCHEN EQUIPMENT CONTRACTOR (KEC) QUALIFICATIONS:

A. In addition to requirements of Related Sections 1.02, submit evidence of compliance with the following qualifications and conditions:

1. Five (5) years minimum continuous operation under the same company name and ownership.
2. Evidence of Company's financial stability and financial ability to complete this Project without endangering that stability.
3. List a minimum of comparable size and scope projects completed in the last five (5) years with Owner's contact name and telephone number.
4. Have manufacturer's authorization to purchase, distribute, and install all items specified with this Project.
5. Maintain a staff or have access to personnel with a minimum of five (5) years experience in the installation of comparable size and scope projects, and meeting NSF standards and requirements. (UL Sanitation standards and requirements may be accepted if acceptable to local code jurisdictions.)
6. Maintain or have access to a fabrication shop meeting NSF standards and labeling requirements. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.) If other than the Kitchen Equipment Contractor (KEC)'s own fabrication shop, they shall have five (5) years minimum experience in the fabrication of comparable size, scope, and level of quality projects. The Kitchen Equipment Contractor (KEC) shall submit their company name and credentials to the Architect, who shall have the right of approval or disapproval
7. Maintain a staff or have access to personnel experienced in the preparation of professional style shop drawings and submittals.
8. Maintain or have access to manufacturer's authorized service personnel together with readily available stock of repair and replacement parts.
9. Any sub-Kitchen Equipment Contractor (KEC) employed by Kitchen Equipment Contractor (KEC) for this Project shall comply with the same qualification requirements.

1.7 SUBSTITUTIONS:

A. Refer to Division 1 for Substitution Request requirements.

1.8 APPROVED SUBSTITUTIONS AND/OR LISTED ALTERNATES:

A. Substitutions approved as noted in article 1.07 and/or any Listed Alternate Manufacturers listed in these Itemized Specifications or added by Addendum may be utilized in lieu of the primary specified manufacturer with the following conditions and understanding:

1. The Project Documents are designed and engineered using the primary specified manufacturer and model. The Kitchen Equipment Contractor (KEC) shall assume total responsibility for any deviations required due to the utilization of a substitution/alternate manufacturer or model including, but not limited to, fitting alternates into the available space, providing directions for required changes, and assuming any and all associated costs for utility, building, food service design, architectural, or engineering changes directly or indirectly related to the substitution.

2. The Kitchen Equipment Contractor (KEC) shall be responsible for supplying the model, which is equal to the primary specified model in regards to general function, features, options, sizes, accessories, utility requirements, finish, operation, and listing approvals. If the Owner or their appointed representative determines at any time during the construction and installation, prior to the final acceptance of the Project, that the substitution/alternate model submitted is not equal to the primary specified model, the Kitchen Equipment Contractor (KEC) shall assume all associated cost and implications required to replace the model submitted with the correct model.
3. The bid proposal shall clearly state any substitutions/alternates which will be utilized, including the manufacturer and model number. The proposal shall also include a data sheet for each substitution/alternate with any and all deviations between the primary specified manufacturer and the substitution/alternate manufacturer itemized and listed on the data sheet. The manufacturers' cut sheets are not acceptable as a substitute for the data sheet. Complex alternates, such as utility distribution systems, exhaust hoods, ventilators, etc., shall include a shop drawing specific to the Project.
4. Inclusion of an alternate manufacturer in the Itemized Specifications is not intended to indicate that there is an equal alternate unit to match every primary specified unit. It shall be the responsibility of the Kitchen Equipment Contractor (KEC) to ensure that the alternate unit submitted matches the primary specified unit and meets the other conditions, as stated above.
5. Manufacturers not approved as substitutions or listed as a Listed Alternate will not be permitted unless submitted for prior approval, as described above and in the General and Supplementary Conditions and applicable Division-1 Specifications Sections.
6. Submittal of a substitution/alternate manufacturer or model shall indicate agreement to the above stated conditions. Solely at the Owner's discretion, failure to comply with any of these conditions or to supply complete and correct data information shall result in the Kitchen Equipment Contractor (KEC) being required to provide the primary specified manufacturer at no additional cost to the Owner or to adjust the Contract cost.

1.9 DISCREPANCIES:

A. Where discrepancies are discovered between the drawings and the specifications regarding quality or quantity, the higher quality or the greater quantity shall be included in the Bid Proposal. The Kitchen Equipment Contractor (KEC) shall notify the Architect, in writing, of any discrepancies discovered and await clarification prior to proceeding with the items or areas in question.

1.10 SUBMITTALS:

A. The Kitchen Equipment Contractor (KEC) shall review all submittals for basic compliance with the Contract Documents and correct as required prior to submitting to the Design Team (Architects/Engineers/ Consultants/Owner) for review. Failure to comply with this requirement, the submission of submittal(s) which are significantly inconsistent with the Contract Documents, or inconsistencies that are discovered during review by a Design Team member shall be justification for reimbursement by the Kitchen Equipment Contractor (KEC) to the Design Team member's company for the "lost" time or for the time required for a second review.

B. Rough-In Drawings:

1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.
2. Submit 1/4-inch (1:50) scale rough-in drawings for approval. These drawings shall be dimensioned from grid lines showing location of ducts, stubs, floor and wall sleeves for ventilation, plumbing, steam, electrical, refrigeration lines, beverage lines, concrete base and curb dimensions as required for equipment so supported.
3. Site-verify mechanical, electrical and ventilating rough-in and sleeve locations.
4. The Kitchen Equipment Contractor (KEC) shall be responsible for the accuracy of the information on their submittals.
5. In the event rough-ins have been accomplished before the award of this contract, the Kitchen Equipment Contractor (KEC) shall check the existing facility and make adjustments to their equipment to suit building conditions and utilities, where possible. If not possible, the Kitchen Equipment Contractor (KEC) shall so state in a letter to the Owner and Architect with reasons and an alternate method and pricing.

C. Shop Drawings:

1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.
2. Submit shop drawings for items of custom fabrication included in this contract. Shop drawings shall be submitted at 3/4-inch (1:20) and/or 1-1/2 inch (1:10) scale and shall show dimensions, materials, details of construction, features and options, installation and relation of adjoining work requiring cutting or close fitting. Shop drawings shall also indicate reinforcements, anchorage and related work required for the complete installation of fixtures.
3. Before proceeding with the fabrication of any item, the Kitchen Equipment Contractor (KEC) shall be responsible for verifying and coordinating all dimensions and details with site dimensions and conditions.

D. Product Data Submittal Manuals:

1. Submit electronic PDF file of Product Data Submittal Manuals with a cover sheet and detailed information on every item included in this Section for approval. Detailed information shall include, but not be limited to, item number, description, quantity, model numbers, options and accessories provided, exact utility requirements, manufacturer's cut-sheets, reference to specific shop drawings, etc. Distribute one additional copy of installation and start-up instructions to the Installer. Mark each data sheet with the applicable project equipment item number. Each data sheet shall include NEMA plug and receptacle configuration for applicable items, where applicable. Every cover sheet and associated detailed submittal shall provide sufficient and complete information to verify that the Kitchen Equipment Contractor (KEC) is providing each item in compliance with the Contract documents.

2. Architect review of drawings, shop details, product data brochures, and service and parts manuals is for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Kitchen Equipment Contractor (KEC) from compliance with the contract documents or departures there from. The Kitchen Equipment Contractor (KEC) remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing their work in a safe, satisfactory, and professional manner.

1.11 OPERATION AND MAINTENANCE DATA MANUALS:

A. Operation And Maintenance Manuals (Service And Parts Manuals): Three (3) bound sets of manuals shall be furnished for items of standard manufacture on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner. Manuals shall be in alphabetical order according to manufacturer, including item numbers and utility options provided for the equipment installed.

1. Installing company's name, address, telephone number, and date of completed installation.
2. Serial numbers of principal pieces of equipment.
3. Part numbers of all replaceable items.
4. Lubrication data and belt sizes.
5. Electrical characteristics including data for motors and heaters.

B. Service Agency List: Submit a complete list of local service agencies with the service and parts manuals for included manufacturers, complete with telephone numbers for all buy-out equipment installed.

C. Provide video tapes for maintenance, training, operation, etc. where available from the manufacturer.

1.12 AS-BUILT/ RECORD DOCUMENTS:

A. Maintain one record set of Food Service Equipment Plans with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation. Provide an "as-built" set in reproducible transparency form and electronic computer disk form.

B. Provide one (1) final set of Product Data Submittal Manuals with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation as a specifications record set.

C. These documents shall be provided on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner.

D. Provide two (2) final complete set of Submittals to be retained by Architect as a Record Set.

1.13 SCHEDULE:

A. General: Time is of the essence in this agreement. Acceptance constitutes a guarantee that the Kitchen Equipment Contractor (KEC) can and will obtain materials, equipment, and manpower to permit overall completion of the entire building project on schedule upon notice to proceed. The Kitchen Equipment Contractor (KEC) shall coordinate their work with the progress schedule, as prepared and updated periodically by the General Kitchen Equipment Contractor (KEC) or Construction Manager. The General Contractor and Kitchen Equipment Contractor shall have access to the existing equipment to disconnect, clean, relocate, and reinstall 1-2 weeks prior to substantial completion.

B. The Kitchen Equipment Contractor (KEC) shall notify the Food Service Consultant and the Architect in writing of anticipated delays not within the realm of control of the Kitchen Equipment Contractor (KEC) immediately upon the Kitchen Equipment Contractor (KEC)'s realization that delays are imminent.

C. The Kitchen Equipment Contractor (KEC) will not be granted relief for failure to meet schedules or failure of manufacturers to meet promised delivery dates unless the Kitchen Equipment Contractor (KEC) can establish, in writing, that orders were received by the manufacturer with reasonable lead times.

D. The Kitchen Equipment Contractor (KEC) shall pay extra charges resulting from special handling or air shipment in order to meet the schedule if insufficient time was allowed in placing factory orders.

1.14 PRODUCT HANDLING:

A. Delivery Of Materials: Deliver materials (except bulk materials) in manufacturer's containers fully identified with manufacturer's name, trade name, type, class, grade, size, color, power requirement, if any, and item number.

B. Storage of Materials, Equipment and Fixtures: Kitchen Equipment Contractor (KEC) is responsible for receiving and warehousing of equipment and fixtures until ready for installation. The Kitchen Equipment Contractor (KEC) will store materials, equipment, and fixtures in sealed containers. They shall be stored off the ground and under cover, protected from damage.

C. Handling Materials and Equipment: The Kitchen Equipment Contractor (KEC) will verify and coordinate conditions at the building site, particularly door and/or wall openings and passages to assure access for all equipment. Pieces too bulky for existing facilities shall be hoisted or otherwise handled with apparatus as required. All special handling equipment charges shall be arranged for and paid for by the Kitchen Equipment Contractor (KEC).

1.15 PRODUCT PROTECTION:

A. The Kitchen Equipment Contractor (KEC) is responsible to protect their equipment against theft or damage during the progress of the project until final acceptance by the Owner. Items delivered to the job site at the Owner's or Contract Manager's request before the site is ready for installation should be signed for as approved by the Owner or Contract Manager.

B. The Kitchen Equipment Contractor (KEC) will use all reasonable means to protect the materials of this Section before, during, and after installation and to protect the associated work and materials of the other trades.

C. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment are not to be used for general storage by other trades and should be locked before leaving the site. Damage and theft resulting from the failure to secure boxes shall be repaired or replaced at the Kitchen Equipment Contractor (KEC)'s own expense. The Kitchen Equipment Contractor (KEC) shall be available, as needed, to open and secure walk-in boxes for the other trades to perform their work related to these walk-in boxes, within the other trades' schedules as not to delay their work.

D. Kitchen Equipment Contractor (KEC) will verify if the flooring is to be acid washed. In the event of this type of cleansing, any equipment constructed of stainless steel shall not be delivered until a minimum of 24 hours after the final cleansing is completed.

1.16 WARRANTY:

A. The Kitchen Equipment Contractor (KEC) is responsible to protect their equipment against theft or damage during the progress of the project until final acceptance by the Owner. Items delivered to the job site at the Owner's or Contract Manager's request before the site is ready for installation should be signed for as approved by the Owner or Contract Manager.

B. The Kitchen Equipment Contractor (KEC) will use all reasonable means to protect the materials of this Section before, during, and after installation and to protect the associated work and materials of the other trades.

C. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment are not to be used for general storage by other trades and should be locked before leaving the site. Damage and theft resulting from the failure to secure boxes shall be repaired or replaced at the Kitchen Equipment Contractor (KEC)'s own expense. The Kitchen Equipment Contractor (KEC) shall be available, as needed, to open and secure walk-in boxes for the other trades to perform their work related to these walk-in boxes, within the other trades' schedules as not to delay their work.

D. Kitchen Equipment Contractor (KEC) will verify if the flooring is to be acid washed. In the event of this type of cleansing, any equipment constructed of stainless steel shall not be delivered until a minimum of 24 hours after the final cleansing is completed.

PART 2 - PRODUCTS (Not Applicable)

2.1 EQUIPMENT:

A. Equipment schedule: Refer to schedule on Foodservice Drawings and Part 5 Itemized Specifications for equipment included in this Section.

2.2 MATERIALS:

A. Metals:

1. Stainless Steel: AISI Type 302/304, hardest workable temper, and No.4 directional polish. Standard gauges are noted in these specifications under Heading 2.04; Section B.1.
2. Galvanized Steel Sheet: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment.

Note: Where painted finish is indicated, provide mill phosphatized treatment in lieu of chemical treatment.

3. Steel Sheet: ASTM A569 hot-rolled carbon steel.
4. Galvanized Steel Pipe: ASTM A53 or ASTM A120, welded or seamless, schedule 40, galvanized.
5. Steel Structural Members: Hot rolled or cold formed, carbon steel unless stainless steel is indicated.

Note: Galvanized Finish (G.I.): ASTM A123 hot-dipped zinc coating, applied after fabrication.

6. Aluminum: ASTM B209B221 sheet, plate and extrusions (as indicated), alloy, temper and finish as determined by manufacture / fabricator, except 0.40-mil natural anodized finish on exposed work unless another finish is indicated.

B. Plastic Laminate: NEMA LD3, Type 2, 0.050" thick, except Type 3, 0.042" for post-forming smooth (non-textured). Color and texture as selected by the Architect/Interior Designer.

1. Comply with NSF Standard No. 35.
2. Veneered with approved waterproof and heat proof cement. Rubber base adhesives are not acceptable.
3. Applied directly over close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free laminated surface; or commercial grade furniture particle board, Cortron or equal.
4. If specified plywood or particle board is unavailable, submit specifications and sample of alternate material for approval. If specified for a “wet” area, only marine grade wood products will be approved for these areas.
5. Exposed faces and edges shall be faced with 1/16 inch (1 .6mm) thick material. Cover corresponding backs with approved backing and balancing sheet material. No unfinished exposed plywood/particle board will be acceptable.

C. Hardwood Work Surfaces: Laminated edge grained hard maple (Acer saccharum), NHLA First Grade with knots, holes and other blemishes culled out, kiln dried at 8 percent or less moisture, waterproof glue, machined, sanded, and finished with NSF approved oil-sealer.

D. Solid Surface Material (SSM): Unless otherwise specified, provide 1/2" thick 100% homogeneous filled acrylic material meeting ANSI Z124.6 Type 6, as manufactured by DuPont Company and known as Corian. Color(s) and pattern(s) as selected by the Architect/ Interior Designer.

1. Comply with NSF Standard No. 51.

2. Acrylic adhesive shall be used for all joints.
3. Install directly over 3/4" thick (minimum) substrate of close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free surface or a commercial grade furniture particle board, Cortron or equal. Provide additional bracing and support as required by the SSM manufacturer.
4. Fabrication shall be by a fabricator trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Fabricator.
5. Installation shall be by an installer trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Installer.
6. All fabrication and installation of Corian and all components attached to or installed in or through Corian shall be in compliance with manufacturer's instructions and the DuPont Corian Food Service Guidelines and Design Manual. Of particular concern are the sections, details, and instructions on the installation of drop-in or built-in hot or cold components.
7. All other Solid Surface Material (SSM), which may be specified by others to be used in food service areas, must comply with NSF certification and ANSI Standard No. 51.

E. Insulation:

1. For low temperature applications, such as ice bins, cold pans, or fabricated under counter freezers, use urethane, rigid board foam or foamed-in-place, not less than 2 inches (50mm) thick, except that vertical surfaces of cold pans and ice bins may be 1 inch (25mm) thick. Insulation shall be bonded at joints to prevent condensation on exterior.
2. For refrigerated applications, such as fabricated undercounter refrigerators, use urethane rigid board foam or foamed-in-place, or Styrofoam rigid board foam 2 inches (50mm) thick, bonded at joints.
3. For heated type applications, such as plate warmers, use block type rock wool, minimum 1 inch (25mm) thick.
4. At counter tops, subject to heat from cooking equipment and refrigeration compressors, use 1-inch (25mm) thick B&Z Products (1-800-999-0890) Marinite I, or equal, to insulate underside of top.
5. Marinite material shall be added between freezer or refrigerator and 14 gauge (2.0) stainless steel top.
6. All insulation shall be fully encased or enclosed.

F. Joint Materials:

1. Sealants: 1-part or 2-part, polyurethane or silicone based, liquid elastomeric sealant, non-solvent release type, Shore A hardness of 30, except 45 if subject to traffic. Sealants shall be NSF Listed for use in food zones. Installation shall comply with applicable requirements of NSF Standards.
2. Backer Rod: 3/8 inch or larger joints shall be polyurethane rod stock, larger than joint width.
3. Gaskets: Solid or hollow (but not cellular) neoprene or polyvinyl chloride, light grey, minimum of 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.

G. Paint and Coatings:

1. Provide the types of painting and coating materials which, after drying or curing, are suitable for use in conjunction with food service, durable, non-toxic, non-dusting, non-flaking, mildew resistant, and comply with governing regulations for food service.
2. Galvanize Repair Paint: MIL-P-21035.
3. Sound Deadener: NSF listed sound deaden material such as latex sound deadener for internal surfaces of metal work and underside of metal counters and tables between work top and underbracing.
4. Pretreatment: SSPC-PT2 or PT3, of FS TT-C490.
5. Primer Coating for Metal: FS TT-P-86, type suitable for baking, where indicated.
6. Enamel for Metal: Synthetic type, FA TT-P-491, type suitable for baking, where indicated.

2.3 FABRICATED PRODUCTS:

A. Hardware:

1. General: Manufacturer's standard, but not less than ANSI 156.9 Type 2 (Institutional), satin finish stainless steel or dull chrome finish on brass, bronze, or steel.
2. Hinged Door Hardware: Hinged doors shall be mounted with heavy duty NSF approved hinges with Component Hardware Group, Model No. P62-1010 pulls, or equal. Catches shall be heavy-duty magnetic type, except as otherwise indicated.
3. Drawer Hardware: Slides to be 200 pounds minimum capacity per pair, 300 series stainless steel, full extension, side-mounting, self-closing type, with stainless steel ball bearings and positive stops, Component Hardware Group Series S52, or equal. Pulls shall be Component Hardware Group, Model No. P62-1 012, or equal.
4. Sliding Door Hardware: Sliding doors shall be mounted on large, quiet ball bearing rollers in 14-gauge (2.0mm) stainless steel overhead tracks, and be removable without the use of tools. Bottom of cabinet shall have stainless steel guide-pins and not channel tracks for doors.
5. All hardware shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.

B. Casters:

1. Type and size as recommended by caster manufacturer, NSF approved for the type and weight of equipment supported, but not less than 5-inch (127mm) diameter heavy-duty, ball bearing, solid or disc wheel with non-marking grease proof rubber, neoprene or polyurethane tire, unless otherwise specified. Minimum width of tread shall be 1-3/16 inch (30mm). Minimum capacity per caster shall be 250 pound (113.4kg), unless otherwise noted in itemized specifications.
2. Provide solid material wheels with stainless steel rotating wheel guard.
3. To be sanitary, provide sealed wheel and swivel bearings and polished plated finish per NSF.
4. Unless otherwise indicated, equip each item with two (2) swivel-type casters and two (2) fixed casters. Provide foot brakes on two (2) casters on opposite front corners of equipment.
5. Unless equipment item is equipped with another form of all-around protective bumper, provide circular rotating bumper above each caster, 5-inch (127mm) diameter tire of light grey synthetic rubber (hollow or closed-cell) on cadmium-plated disc.

C. Plumbing Fittings, Trim and Accessories:

1. General: Where exposed or semi-exposed, provide bright chrome plated brass or polished stainless steel units. Provide copper or brass where not exposed.
2. Vacuum Breakers: Provide with food service equipment as listed in the itemized specifications.
3. Water Outlets: At sinks and at other locations where water is supplied (by manual, automatic or remote control), furnish commercial quality faucets, valves, dispensers or fill devices of the type and size indicated and as required to operate as indicated.
4. Waste Fittings: Except as otherwise indicated, furnish 2-inch (50mm) remote-lever waste valve and 3-1/2 inch (89mm) strainer basket.

D. Electrical Materials:

1. General: Provide standard materials, devices and components as recommended by the manufacturer or fabricator, selected and installed in accordance with NEMA standards and recommendations and as required for safe and efficient use and operation of the food service equipment without objectionable noise, vibration and sanitation problems.
2. Before ordering equipment, confirm pertinent electrical requirements with the serving electrical utility, such as actual voltages available, number of phases and number of wires in the system.
3. Wire electrical work for fabricated equipment completely to a junction or pull box which is wholly accessible and mounted on the equipment. Wiring shall be labeled for outlet or item served. Verify local requirements for UL Listing on complete assembly, and provide if required.
4. Components shall bear the UL label or be approved by the prevailing authority.
5. Provied Custom fabricated refrigerator units with vapor tight light receptacles, shatterproof lamps and automatic switches. Conceal wiring.
6. Controls and Signals: Provide recognized commercial grade signals, on-off push buttons or switches, and other speed and temperature controls as required for operation, complete with pilot lights and permanent signs and graphics to assist the user of each item. Provide stainless steel cover plates at control and signal electrical boxes. Locate controls and switches out of heat zones, in easily accessible locations that preclude accidental contact by employees.
7. Internal Wiring of Fixtures and Equipment:

    a. The Kitchen Equipment Contractor (KEC) shall be responsible for internal wiring of electrical devices built into or forming an integral part of fabricated equipment items. Wiring will be in metal conduit, connected to an accessible pull-box or j-box, and tagged for intended use. Refer to Section 26 Specifications for color coding of wiring.
    b. Each standard item shipped in sections shall be properly connected internally and verified by the Kitchen Equipment Contractor (KEC).
    c. Furnish dish washers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.
    d. Where light fixtures are specified or detailed as part of counters, furnish and install cases or fixtures, light fixtures, lamps and shields. Provide warm white lamps unless otherwise specified. If fluorescent light fixtures are specified, provide ballasts and include shields. Provide shields for all light fixtures.

e. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:

1) In heat zone: shall have UL approved insulation and be not less than 300-volt rated heat resistant insulation with nickel wire.
2) Connection wiring extended in raceway or conduit to junction or pull box shall be not less than 600 volt rated heat resistant insulation covered wire, UL approved, or equal.

f. Wiring for fabricated refrigerator and freezer cabinets shall be UL approved insulated cable from exterior junction box to internal components, within insulation unless code requires metallic conduit:

1) Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal-Tite Flex or approved equal shall be used.
2) Internal wiring shall be UL approved rubber covered 600 volt rated conductor, except door heaters, which shall be Nichrome wire with silicone braided jacket, having resistance of 10.4 watts per lineal foot.
3) Mount convenience outlets, lighting receptacles, (rubber or porcelain) and door switches in approved boxes. Convenience outlets for evaporators shall be twist lock type. Solid connections, as for freezer evaporators, shall be made vapor tight.

g. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed Seal -Tite conduit equal to Anaconda type "UA". UL approved, complete with approved liquid tight connectors on each end, and designed to provide electrical grounding continuity.
h. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) shall not be permitted for wet areas. Exposed outlet boxes shall be liquid tight type, with threaded hubs.

8. Convenience and Power Outlets:

a. Make cutouts and install appropriate boxes or outlets in fabricated fixtures, complete with wiring, conduit, outlet and stainless-steel cover plate.
b. Outlets and plugs shall conform to NEMA standards.
c. Electrical outlets and devices shall be first quality "Specification Grade".
d. Furnish GFCI outlets where adjacent to sink compartments, as per the National Electrical Code.

9. Plugs and Cords: Where cords and plugs are provided, they shall comply with National Electrical Manufacturer's Association (NEMA) requirements. Indicate NEMA configuration for each applicable item.
10. Heating Equipment:

a. Install electric and heating equipment as to be readily cleanable or removable for cleaning.
b. Steam heated custom fabricated equipment shall be a self-contained assembly, complete with control valves located in an accessible position.

11. Motors: Totally enclosed type, except drip-proof type where not exposed to a dust or moisture condition; ball bearings, except sleeve bearings on small timing motors; windings impregnated to resist moisture; horse-power and duty-cycle ratings as required for the service indicated.
12. Power Characteristics: Refer to Division 26 specifications for project power characteristics. Also, refer to individual equipment requirements, for loads and ratings.

2.4 FABRICATION OF METAL WORK:

A. General Fabrication Requirements:

1. Remove burrs from sheared edges of metalwork, ease the corners and smooth to eliminate cutting hazard. Bend sheets of metal, at not less than the minimum radius required to avoid grain separation in the metal. Maintain flat, smooth surfaces, without damage to finish.
2. Reinforce metal at locations of hardware, anchorages and accessory attachments wherever metal is less than 14-gauge (2.0mm), or requires mortised application. Conceal reinforcements to the greatest extent possible. Weld in place, on concealed faces.
3. Exposed screws or bolt heads, rivets and butt joints made by riveting straps under seams and then filled with solder, will not be accepted. Where fasteners are permitted, provide Phillips head, flat or oval head machine screws. Cap threads with acorn nuts, unless fully concealed in inaccessible construction; and provide nuts and lock washers unless metal for tapping is at least 12-gauge (2.5mm). Match fastener head finish with finish of metal fastened.
4. Where components of fabricated metal work are indicated to be galvanized, and involve welding or machining of metal heavier than 16-gauge (1.6mm), complete the fabrication and provide hot-dip galvanizing of each component, after fabrication, to the greatest extent possible (depending upon available dip-tank sizes). Comply with ASTM A123.
5. Welding and Soldering:

    a. Materials 18-gauge (1.27mm), or heavier, shall be welded.
    b. Seams and joints shall be shop welded or soldered as the nature of the material may require.
    c. Welds must be ground smooth and polished to match original finish.
    d. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high grade aluminum paint.

6. Provide removable panels for access to mechanical and electrical service connections, which are concealed behind or within foodservice equipment, but only where access is not possible and not indicated through other work.
7. Closures: Where ends of fixtures, splash back’s, shelves, etc., are open, fill by forming the metal, or welding sections, if necessary, to close entire opening flush to walls or adjoining fixtures.
8. Rolled Edges: Rolled edges shall be as detailed, with corners bull nose, ground and polished.
9. Coved Corners: Stainless steel foodservice equipment shall have 1/2 inch (13mm) or larger radius coves in horizontal and vertical corners, and intersections, per N.S.F. standards.

B. Metal and Gauges:

1. Except as otherwise indicated, fabricate exposed metalwork of stainless steel; and fabricate the following components from the gauge of metal indicated, and other components from not less than 20-gauge (0.8mm) metal:

a.	Table and counter tops:	14 gauge.
b.	Sinks and drain boards:	14 gauge.
c.	Shelves:	16 gauge.
d.	Front drawer and door panels:	18 gauge (double pan construction).
e.	Single pan doors and drawer fronts:	16 gauge.
f.	Enclosed base cabinets:	18 gauge.
g.	Enclosed wall cabinets:	18 gauge.
h.	Exhaust hoods and ventilators:	18 gauge.
i.	Pan-type insets and trays:	16 gauge.
j.	Removable covers and panels:	18 gauge.
k.	Skirts and enclosure panels:	18 gauge.
l.	Closure and trim strips over 4" wide:	18 gauge.
m.	Hardware reinforcement:	12 gauge.
n.	Gusset plates:	10 gauge.

C. Work-Surface Fabrication:

1. Fabricate metal work surfaces by forming and welding, to provide seamless construction; using welding rods matching sheet metal, grinding and polishing. Where necessary for disassembly, provide waterproof gasketed draw-type joints with concealed bolting.
2. Reinforce work surfaces 30 inches on center both ways, with galvanized or stainless steel concealed structural members. Reinforce edges, which are not self-reinforced, by formed edges.

D. Metal Top Construction:

1. Metal tops shall be one-piece welded construction, including field joints. Secure to a full perimeter galvanized steel channel frame cross-braced not farther than 2'-6" (760mm) on center. Fasten top with stud bolts or tack welds. If hat sections are used in lieu of channels, close ends.
2. Properly designed draw fastening, trim strip, or commercial joint material to suit requirement shall be used, only if specified.

E. Structural Framing:

1. Except as otherwise indicated, provide framing of minimum 1-inch (25mm) pipe-size round pipe or tube members, with mitered and welded joints and gusset plates, ground smooth. Provide 14 gauge (2.0mm) stainless steel tube for exposed framing, and galvanized steel pipe for concealed framing.
2. Where indicated, flange rear and end edges up to form splashes integrally with top, with vertical and horizontal corners coved of not less than 1/4-inch (6mm) radius, die formed. Turn back splashes 1 inch to wall across top and ends with rounded edge on break, unless otherwise specified.

3. For die-crimped edges, use inverted "V" 1/2 inch (13mm) deep inside and 2 inch (38mm) deep on outside, unless otherwise shown. For straight down flanges, make 1- 3/4 inch (45mm) deep on outside. For bull nose edges, roll down 1-3/4 inch (45mm).
4. Edges: die-formed, integral with top. For rounded corners, form to 1-inch radius, weld, and polish to original finish.

F. Field Joints: For any field joint required because of size of fixture; butt-joint, reinforce on underside with angles of same material, bolt together with non-corrosive bolts and nuts, field weld, grind and polish.

G. Pipe Bases: Construct pipe bases of 1-5/8-inch (41mm) diameter 18 gauge (1.2mm) stainless steel tubing. Fit legs with polished stainless steel sanitary adjustable bullet feet to provide for adjustment of approximately 1-1/2 inch (38mm), without exposing threads. Space legs to provide ample support for tops, precluding any possibility of buckling or sagging and in no case more than 6'-0" centers.

H. Legs and Cross-rails

1. Equipment legs and cross rails shall be 1-5/8 inch (41mm), 16-gauge (1 .59mm) stainless steel tubing.
2. Welds at cross rails shall be continuous and ground smooth. Please note; tack welds are not acceptable.
3. Bottom of legs shall be cambered inward and fitted with a stainless-steel bullet-type foot with not less than 2 inch (50mm) adjustment. Flanged feet with bolt holes may be required dependent on design applications. Provide proper type feet in compliance with local codes. Stainless steel to be used in all applications.
4. Free standing legs shall be pegged to floor with 1/4 inch (6mm) stainless steel rod.
5. Components:

    a. Stainless Steel Gusset: Stainless steel exterior to fit 1-5/8-inch (41mm) tubing, with Allen screw for fastening and adjustment. Not less than 3 inches (76mm) diameter at top and 3-3/4-inch (95mm) long. Outer shell 16-gauge (1.6mm) stainless steel, reinforced with 12-gauge (2.5mm) mild steel insert welded interior shell, or approved equal.
    b. Stainless Steel Low Counter Legs: Stainless steel exterior 5-3/4-inch (146mm) minimum, 7 inch (1 78mm) maximum length with stainless steel 3- 1/2 inch (89mm) square plate with four counter-sunk holes, welded to top for fastening.
    c. Stainless Steel Adjustable Foot: Stainless steel 1-1/2-inch (38mm) diameter tapered at bottom to 1 inch (25mm) diameter, fitted with threaded cold rolled rod for minimum 1-1/2 inch (38mm) diameter x 3/4 inch (19mm) threaded bushing plug welded to legs, or approved equal. Push-in foot not acceptable.

6. Legs shall be fastened to equipment with gussets, as follows:

    a. Sinks: Reinforced with bushings and set screw.
    b. Metal Top Tables and Dish Tables: Welded to galvanized steel channels, 14-gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.
    c. Wood Top Tables: Welded to stainless steel channels, 14-gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.

I. Shelves:

1. Construct solid shelves under pipe base tables of 16-gauge stainless steel, with 1-1/2 inch turned down and under edges on exposed sides, and 2 inch turn up against walls or equipment. Fully weld to pipe legs.
2. In fixtures with enclosed bases, turn up shelves on back and sides with 1/4-inch (6mm) (minimum) radius and feather slightly to ensure a tight fit to enclosure panels.

J. Sinks:

1. Construct sinks of 14-gauge stainless steel with No.4 finish inside and outside.
2. Form back, bottom and front of one piece, with ends and partitions welded into place. Partitions: double thickness, 1-inch minimum space between walls. Multiple compartments shall be continuous on the exterior, without applied facing strips or panels.
3. Cove interior vertical and horizontal corners of each tub not less than 1/4-inch radius, die formed. Outer ends of drain boards to have roll rim risers not less than 3 inches high.
4. Drill faucet holes in splashes 2-1/2 inches below top edge. Verify center spacing with faucet specified.
5. Sink insets shall be deep drawn of 16-gauge (1 .59mm), or heavier, polished stainless steel. Weld into sink drain boards with 1-1/2-inch x 1-1/2-inch x 14-gauge stainless steel angle brackets; securely welded to sinks and galvanized cross angles spot welded to underside of drain boards to form an integral part of the installation.
6. The bottom of each compartment shall be creased such as to ensure complete drainage to waste opening. Slope bottom of sink bowls toward outlet.

K. Drains, Wastes and Faucets:

1. Furnish and install T&S Brass faucets model B-3940-01 stainless steel rotary drain assembly with connected overflow assembly, in die-drawn inset type sinks and bain-marie sinks.
2. Other custom fabricated sinks shall be furnished with T&S Brass faucets model B3940-01 stainless steel rotary drain assembly, with STAINLESS STEEL cap nut over overflow outlet. Waste connection shall have 2 inch (50mm) external thread size, with 1-1/2 inch (38mm) internal thread size.
3. Rotary Handle: Of sufficient length to extend to front edge of sink. No riveting, screws or soldering permitted to fit drains to sinks, with all parts of drains easily removable for servicing and replacement. Rotary handle bracket to be provided as part of the sink fabrication.
4. Water pans for steam tables shall be fitted with 1-inch (25mm) drains with chrome-plated brass stand pipes.
5. All faucets furnished with equipment included in this Section shall be lead free and comply with NSF Standard #61, Section #9; such as manufactured by Fisher, Chicago, or T&S. Where the itemized specifications list a faucet by manufacturer and model, the Kitchen Equipment Contractor (KEC) shall verify that the listed faucet complies with this requirement.
6. If the listed faucet does not comply, the Kitchen Equipment Contractor (KEC) shall submit similar model which does comply, from the same manufacturer where available or from one of the above manufacturers.

L. Workmanship:

1. Best quality in the trade. Field verify dimensions before fabricating; conform all items to dimensions of building; neatly fit around pipes, offsets and other obstructions.
2. Fabricate only in accordance with approved shop drawings, showing pipes, obstructions to be built around, and location of utilities and services.

M. Enclosures:

1. Provide enclosures, including panels, housings, and skirts for service lines, operating components and mechanical and electrical devices associated with the foodservice equipment, except as specifically indicated to be "open".
2. Where equipment is exposed to customer view, provide enclosure of service lines, operating components and mechanical and electrical devices.

N. Casework:

1. Enclosure: except as otherwise indicated, provide each unit of casework (base, wall, overhead and free-standing) with a complete-enclosure metal cabinet, including fronts, backs, tops, bottoms, and sides.
2. Bases shall be made of 18-gauge (1.27mm) stainless steel sheets reinforced by forming the metal.
3. Ends, partitions and shelves are stainless steel.
4. Unexposed backs and structural members are galvanized.
5. Vertical ends and partitions are single wall, with a 2 inch (50mm) face.
6. Sides and through partitions are flush with bottom rail, welded at intersections.
7. Shelves: Provide adjustable standards for positioning and support of shelves in casework; except bottom shelf of cabinet mounted on legs or as specified. Turn back of shelf units up 2 inches, and hem. Turn other edges down to form open channel. Reinforce shelf units to support 40 pounds per square foot loading, plus 100 percent impact loading.
8. Bottom front rail of bases set on masonry platform shall be continuously closed and sealed to platform.

O. Doors:

1. Metal doors shall be double-cased stainless steel. Outer pans shall be 18-gauge (1.27mm) stainless steel with corners welded, ground smooth and polished. Inner pan shall be 20-gauge (.95mm) stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or Styrofoam used as a core. The two pans shall be tack welded together and joints solder filled. Doors shall finish approximately 3/4 inch (19mm) thick, and be fitted with flush recessed type stainless steel door pulls.
2. Wood doors shall be fabricated as detailed. If Formica or other plastic surfaces are used, sides and backs must be laminated.
3. Hinged doors shall be mounted on heavy-duty N.S.F. approved hinges, or as noted on plans or specifications.

P. Drawer Assemblies:

1. Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with fully enclosed housing.

2. Slide assembly consists of one pair of 200 pound stainless steel roller bearing extension slides, with side and back enclosure panels, front spacer angle, two drawer carrier angles, secured to slides and stainless steel front.
3. Drawer bodies for general storage are to be 20 inches x 20 inches (508mm x 508mm), with 18 gauge stainless steel containers.
4. Drawers intended to hold food products shall be removable type with 12 x 20 (305mm x 508mm) stainless steel food pans, in a stainless steel assembly.
5. Drawer fronts are double cased, 3/4 inch (19mm) thick, with 18 gauge (1.27mm) stainless steel welded and polished front pan. Steel back pan is tightly fitted and tack welded. Sound deaden with rigid insulation material.
6. Provide drawers with replaceable soft neoprene bumpers or for refrigerated drawers, a full perimeter soft gasket.

Q. Closed Base: Where casework is indicated to be located on a raised-floor base, prepare casework for support without legs, and for anchorage and sealant application, as required for a completely enclosed and concealed base.

R. Support from Floor: Equip floor supported mobile units with casters, and equip items indicated as roll-out units, with manufacturer's standard one-directional rollers. Otherwise, and except for closed-base units, provide pipe or tube legs, with adjustable bullet-design feet for floor supported items of fabricated metalwork. Provide 1-1/2 inch adjustment of feet (concealed threading).

S. Shop Painting:

1. Clean and prepare metal surfaces to be painted; remove rust and dirt. Apply treatment to zinc coated surfaces, which have not been mill phosphatized. Coat welded and abraded areas of zinc coated surfaces, with galvanize repair paint.
2. Apply 1.5 mil (dry film thickness) metal primer coating, followed by 2, 1.0 mil (dry film thickness) metal enamel finish coatings.
3. Bake primer and finish coatings in accordance with paint manufacturer's instructions for a baked enamel finish.

T. Sound Deadening:

1. Sound deaden underside of metal tops, drain boards, under shelves, cabinet interior shelves, etc., above the underbracing/reinforcing/framing only.

2.5 FILTER EXHAUST HOODS, WATER WASH VENTILATOR FABRICATION AND ULTRAVIOLET:

A. Filter Exhaust Hoods:

1. 18 Gauge type 304 stainless steel external welded construction, in accordance with the latest edition of NFPA No.96, including all applicable appendices. Exposed welds to be ground and polished.
2. Grease Removal: UL classified, non-adjustable, stainless steel grease filters with drip-channel gutters, drains and collection basins.
3. Light Fixtures: Furnish type of fixture specified. Fixtures shall be UL listed for hoods, NSF approved, with sealed safety lenses and stainless steel exposed conduit for wiring.

4. Exhaust Duct: Furnish welded stainless steel formed duct collars at ceiling or wall duct connections, where exposed. Furnish exposed to view ductwork as specified. Verify size and location of duct connections required in this contract, before fabrication. Other ductwork will be by the Mechanical Section.
5. Fire Extinguishing System: Pre-piped liquid chemical or water fire suppressant system, as specified, complying with applicable local and NFPA regulations. Wet chemical fire suppression systems shall comply with UL 300 Standards.

2.6 REFRIGERATION EQUIPMENT:

A. General:

1. Furnish either single or multiple compressor units, as specified or recommended by the manufacturer for the sizes and variations between connected evaporator loads as indicated.
2. Furnish units of the capacities indicated, arranged to respond to multiple-evaporator thermostats and defrosting timers. Include coils, receivers, compressors, motors, motor starters, mounting bases, vibration isolation units, fans, dryers, valves, piping, insulation, gauges, winter control equipment and complete automatic control system.
3. Refrigerant: Pre-charge units with type or types recommended by manufacturer for services indicated, with quick-disconnect type connections where specified, ready to receive refrigerant piping runs to evaporators and (where remote) to condensers. All refrigerant and associated components shall comply with the requirements of the Montreal Protocol Agreement. No CFC refrigerants or associated components shall be allowed on this Project. HFC refrigerants and components shall be used where available. HCFC refrigerants and components, with a minimum 2010 phase-out date, and intermediate replacement refrigerants are to be used only when HFC refrigerants are not available. Kitchen Equipment Contractor (KEC) shall be responsible for coordinating with manufacturers. Provide refrigerant leak monitoring devices where required by federal, state, or local codes.
4. The minimum outdoor operating ambient temperature for design of units is -10 degrees Fahrenheit, or as applicable for extreme low local conditions. The maximum indoor design temperature for operation of compressor units is 95 degrees Fahrenheit. The maximum outdoor ambient design temperature shall be determined with prevailing conditions at mounting location(s) of compressor(s), such as sun exposure, limited ventilation, high fences/walls, roof color and materials, local climatic extremes, etc., but in no case, shall it be less than 100 degrees Fahrenheit.

B. Components:

1. Coils: Coils for fabricated refrigerators shall have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
2. Expansion Valves: Remote refrigeration system shall be complete with thermostatic expansion valves at the evaporator.
3. Thermometers:

   a. Fabricated refrigerated compartments to be fitted minimally with a flush dial thermometer, with chrome plated bezels and to be provided as specified.
   b. Thermometers shall be adjustable and shall be calibrated after installation.
   c. Thermometers shall have an accuracy of ± 2 degrees Fahrenheit (1 degree Centigrade).

4. Hardware:

   a. Refrigerator hardware for fabricated refrigerator compartments shall be heavy-duty components.
   b. Self closing hinges.
   c. Latches to be magnetic edge mount type, unless specified or detailed otherwise.

5. Locks:

   a. Doors and drawers for walk-in coolers/freezers and reach-in refrigerated compartments, both fabricated and standard, shall be fitted with cylinder locking type latches and provided with master keys.

C. Cold Pans: Ice pans, refrigerated pans and cabinets shall be provided with breaker strips, where adjoining top or cabinet face materials, to prevent transfer of cold.

D. All open top mechanically cooled custom fabricated or standard buy-out refrigerators and/or cold pans shall comply with NSF Standard #7 requirements, as of April 1, 1998. The Kitchen Equipment Contractor (KEC) shall verify that the specified unit complies with this requirement or submit a similar model, which does comply, from the same manufacturer where available.

E. Ventilation of Refrigerated Equipment:

1. Adequate ventilation shall be provided for custom fabricated equipment with integral refrigeration condensing units, both built-in and drop-in. If flow through ventilation cannot be provided, provide flow direction partitions and an additional fan capable of cooling the condensing unit.
2. If, in the opinion of the Kitchen Equipment Contractor (KEC), additional room ventilation is required to ensure correct operating temperatures of standard buy-out, custom fabricated or remote refrigeration condensing units, or compressor rack assemblies, they shall so state in a letter to the Architect for evaluation and direction.

2.7 MISCELLANEOUS MATERIALS:

A. Nameplates: Whenever possible, locate nameplates and labels on manufactured items, in accessible position, but not within customer's normal view. Do not apply name-plates or labels on custom fabricated work, except as required for compliance with governing regulations, insurance requirements, or operator performance.

B. Manufactured Equipment Items: Furnish items as scheduled or herein specified. Verify dimensions, spaces, rough-in and service requirements, and electrical characteristics before ordering. Provide trim, accessories and miscellaneous items for complete installation.

C. Insert Pans:

1. General: Provide cut-outs, openings, drawers, or equipment specified or detailed to hold stainless steel insert pans with a full complement of pans as follows:
2. One (1) stainless steel, 20-gauge (0.95mm) minimum, solid insert pan for each space, sized per plans, details, or specifications.
3. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size pan for each opening.

4. Provide maximum depth pan to suit application and space.
5. Provide 18-gauge (1.27mm) removable stainless steel adapter bars where applicable.
6. Provide all cut-outs and openings or equipment specified or detailed to hold stainless steel insert pans with a hinged stainless steel removable night cover.

D. Tray Slides: Before fabrication of counters with tray slides, verify:

1. Size and shape of tray. Edge of tray shall not overhang outer support/slider by more than 2". If edge of tray exceeds this dimension, notify Architect, in writing, for evaluation and adjustment, if necessary.
2. Configuration of corners, turns, and shape of tray slides for proper support and safe guidance of trays.
3. Tray slide capable of supporting 200 pounds per linear foot, live load.

E. Self-leveling dispensers: Verify type and make of ware, dimensions and weight, request samples from Operator and submit to the dispenser manufacturer for proper sizing and calibration of dispensers.

F. Carbon dioxide (co') equipment: Where equipment requires connection with compressed co' cylinder for operation, provide proper sized cylinder manifold and control system (integral with equipment) with proper connectors for Department of Transportation (DOT) approved type cylinders, complete with cylinder safety devices and supports.

G. Reasonable quietness of operation of equipment is a requirement. The Kitchen Equipment Contractor will be required to replace or repair any equipment producing out-of-the-ordinary intolerable noise. This also includes providing and installing bumpers and gaskets for doors and drawers on fabricated and standard manufactured items and sound insulation where feasible.

2.8 ITEMIZED SPECIFICATIONS

A. Refer to the following pages for specific specification information on each item included in this Section.

ITEM 1 WALK-IN COLD STORAGE ROOMS: 2 REQUIRED

A. Imperial Manufacturing, modular sandwich panel design Foam-A-Lite *H011 cold storage rooms complete in configuration shown on Sheet FS1.01. Each room shall incorporate the following:

1. Provide two 60” x 96" horizontal single electric sliding doors and door frames (heated for freezer) 22-gauge stainless steel inside and out (no wood construction) with 14" x 14" glass window (heated for freezer), and 36" high 1/8" thick aluminum diamond treadplate interior and exterior kick plates. Include stainless steel cover for door track and electric operator. Provide with manual lock hasp. Include doors with ICC-5 Operator for Owner furnished card reader software.
2. Exposed exterior wall panels and closure panels/trim strips to adjacent walls and ceiling shall be 20-gauge Type 304, No. 4 finish stainless steel. Exposed interior shall be .040 stucco embossed aluminum except ceiling which shall be .040 aluminum with white acrylic finish. Unexposed surfaces shall be 26-gauge galvanized steel.
3. Finished exterior height of 9'-0". All insulation shall be 4" thick foamed in place, Class 1, urethane insulation excluding floor insulation which shall be 6" thick R-Max board stock urethane.

4. Install surface mounted 4-1/2" diameter dial thermometers above each door.
5. Install floor in floor depression complete with insulation noted above and vapor barrier of 15 lb. felt protective slip sheet applied over insulation and flashed up height of cove and joints lapped 6 inch minimum. Refer to Architectural Room Finished Schedule for wearing floor and base material inside and out by Division 9.
6. Kason #1825 heated vacuum vent for freezers.
7. Provide 3/8-inch diameter nylon coil hangers mounted on 3 inch by 3 inch aluminum plates with nuts and retainers to support evaporators hung from ceiling panel.
8. Furnish penetrations to accommodate all electrical, plumbing, and refrigeration lines. Furnish stainless steel escutcheons.
9. Provide Kason 1810 LED cooler and freezer ceiling light fixtures as noted on Sheet FS1.04. Field connections under Division 26 Electrical Contractor. Include lamps.
10. Provide flush mount, press type, switches with constant burning light and weather-proof covers mounted inside and outside of each room as indicated on electrical plan.
11. All electrical conduits shall be run concealed within the walk-in walls or above the ceiling panels.
12. Interior and exposed exterior seismic tie-downs at floor and ceiling level as required by codes.
13. Field verify all dimensions before submittals are issued.

B. Refer to Sheet FS2.01 for additional requirements and details.

C. Walk-ins shall be installed by this manufacturer or this manufacturer's certified installer only with a minimum of 5 years experience.

ITEM 2 REFRIGERATION SYSTEMS: 7 REQUIRED

A. System A: Walk-In Freezer @ -0°F to -10°F

1. Evaporators: Two (2) Larkin LCE6180BBEC-B; 18,000 BTU at -15F° suction temperature. Include expansion valve and drier-strainer.
2. Condensing Units: Two (2) Larkin LZS045L6C; 18,300 BTU at +90F° ambient air temperature.

B. System C: Walk-In Meat/Dairy Thaw Cooler @ +35F° to +40F°

1. Evaporator: Larkin LCA6135ABEC-B; 13,500 BTU at +25F° suction temperature. Include expansion valve and drier-strainer.
2. Condensing Unit: Two (2) Larkin LZS030M6C; 28,630 BTU at +90F° ambient air temperature.

C. System D: Produce Cooler @ +35F° to +40F°

1. Evaporator: Larkin LCA6135ABEC-B; 13,500 BTU at +25F° suction temperature. Include expansion valve and drier-strainer.
2. Condensing Unit: Larkin LHS015X6C; 15,500BTU BTU at +90F° ambient air temperature.

D. System E: Walk-in Finishing Cooler @ +35F° to +40F°

1. Evaporators: Two (2) Larkin LCA6260ABEC-B; 26,000 BTU at -15F° suction temperature. Include expansion valve and drier-strainer.
2. Condensing Units: Two (2) Larkin LZS030M6C; 28,630 BTU at +90F° ambient air temperature.

E. System G: Blast Chillers @ -5°F to -10°F

1. Evaporators: Furnished with the Blast Chiller.
2. Condensing Units: Three (3) Larkin LDT1000L6C; 82,100 BTU at +90F° ambient air temperature.

F. System G: Blast Chiller @ -5°F to -10°F

1. Evaporators: Future Equipment.
2. Condensing Units: Future Equipment.

G. Each system shall incorporate the following:

1. Flexible vibration eliminator in suction line.
2. Circuit breaker, automatic starting switch, motor protectors and pressure limit switch; all enclosed with interconnecting wire installed in a junction box ready for line connections.
3. Liquid line sight glasses.
4. Liquid line dehydrator filter of ample capacity.
5. Suction line filter of ample capacity.
6. Solenoid valve.
7. Thermostat set to cut-in at -5F° and cut-out at -10F° for freezers. Cut-in at +38F° and cut-out at +40F° for refrigerator.
8. Suction pressure regulator.
9. Crank case heater.
10. Refrigerant Lines: Hard copper "L" with "Silfos" brazed joints. Use refrigeration service tubing.
11. Full charge refrigerant oil.
12. Condensing units are located in the second-floor mechanical room. Verify exact location on Architectural plans.
13. Install Beacon System control boxes in kitchen office as shown.

H. Where refrigerant suction lines are trapped, use next size smaller pipe in vertical portion of the trap than that indicated so as to acquire sufficient gas velocity for proper oil return.

I. Provide anti-sweat pipe covering of 3/4" Armstrong Armaflex or equivalent for suction lines from evaporator to condensing unit.

J. Provide painted 1" drain tubing from evaporators to nearest indirect drain as shown on Sheets FS1.02. Trap at outlet end.

K. Provide Raychem, model H611250 heating cable with H900 power connection to wrap all drain lines running through freezers

L. Evaporators and condensing units as shown on the Contract Documents shall be installed under the supervision of a licensed Refrigeration Contractor subject to review by the Consultant.

M. Provide testing, charging, adjusting, operational testing, and cleaning of equipment and lines.

ITEM 3 WALK-IN KITCHEN FREEZER SHELVING: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 4 WALK-IN COOLER DUNNAGE RACKS: 4 REQUIRED

A. Owner furnished and installed.

ITEM 5 WALK-IN THAW ROOM SHELVING: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 6 MOBILE QUEEN MARY SHELVING: 30 REQUIRED

A. (7) are existing equipment.

B. Provide (23) Eagle Group, model QM2977-5-SR/D *H011.

ITEM 7 CORNER/CHANNEL GUARDS: 1 LOT REQUIRED

A. Fabricate as detailed and construct vertical corner/channel guards and low wall caps of one piece all welded 14-gauge stainless steel. Install in locations shown on Sheet FS1.01. Install with stainless steel screws.

B. Seal guards to walls and at joints as required.

ITEM 8 NOT USED

ITEM 9 NOT USED

ITEM 10 WALK-IN PRODUCE COOLER SHELVING: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 11 WALK-IN COLD STORAGE ROOMS: 2 REQUIRED

A. Imperial Manufacturing, modular sandwich panel design Foam-A-Lite *H011 cold storage rooms complete in configuration shown on Sheet FS1.01. Each room shall incorporate the following:

1. Provide two cooler walk-in doors and door frames 48-inch x 78-inch stainless steel inside and out with 14 inch x 14 inch insulated glass window and 36” high 1/8” polished aluminum diamond treadplate interior and exterior kick plates. Door hinged as shown on plan. Include Kason #944 deadbolt mortise lockset with interior safety release, Kason #1229 chrome pull handle, Kason #1094000013 concealed mounting door closer, and three Kason #1248 chrome spring assisted hinges. Hinge door as shown on plans.

2. Provide two 60” x 96" horizontal single electric sliding doors and door frames (heated for freezer) 22-gauge stainless steel inside and out (no wood construction) with 14" x 14" glass window (heated for freezer), and 36" high 1/8" thick aluminum diamond treadplate interior and exterior kick plates. Include stainless steel cover for door track and electric operator. Provide with manual lock hasp.
3. Exposed exterior wall panels and closure panels/trim strips to adjacent walls and ceiling shall be 20-gauge Type 304, No. 4 finish stainless steel. Exposed interior shall be .040 stucco embossed aluminum except ceiling which shall be .040 aluminum with white acrylic finish. Unexposed surfaces shall be 26-gauge galvanized steel.
4. Finished exterior height of 9'-0". All insulation shall be 4" thick foamed in place, Class 1, urethane insulation excluding floor insulation which shall be 6" thick R-Max board stock urethane.
5. Install surface mounted 4-1/2" diameter dial thermometers above each door.
6. Install floor in floor depression complete with insulation noted above and vapor barrier of 15 lb. felt protective slip sheet applied over insulation and flashed up height of cove and joints lapped 6 inch minimum. Refer to Architectural Room Finished Schedule for wearing floor and base material inside and out by Division 9.
7. Provide 3/8-inch diameter nylon coil hangers mounted on 3 inch by 3 inch aluminum plates with nuts and retainers to support evaporators hung from ceiling panel.
8. Furnish penetrations to accommodate all electrical, plumbing, and refrigeration lines. Furnish stainless steel escutcheons.
9. Provide Kason 1810 LED ceiling light fixtures as noted on Sheet FS1.04. Field connections under Division 26 Electrical Contractor. Include lamps.
10. Provide flush mount, press type, switches with constant burning light and weather-proof covers mounted inside and outside of each room as indicated on electrical plan.
11. All electrical conduits shall be run concealed within the walk-in walls or above the ceiling panels.
12. Interior and exposed exterior seismic tie-downs at floor and ceiling level as required by codes.
13. Field verify all dimensions before submittals are issued.

B. Refer to Sheet FS2.01 for additional requirements and details.

C. Walk-ins shall be installed by this manufacturer or this manufacturer’s certified installer only with a minimum of 5 years experience.

ITEM 12 NOT USED

ITEM 13 NOT USED

ITEM 14 NOT USED

ITEM 15 DRY STORAGE DUNNAGE RACKS: 6 REQUIRED

A. Owner furnished and installed.

ITEM 16 KITCHEN DRY STORAGE SHELVING: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 17 PIZZA PREP-TOP REFRIGERATOR: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 18 SNACK TRANSPORT CARTS: 30 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 19 GLASS DOOR REFRIGERATOR: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 20 GLASS DOOR FREEZER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 21 REACH-IN DUAL TEMP REFRIGERATOR/FREEZER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 22 REACH-IN DUAL TEMP REFRIGERATOR/FREEZER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 23 REACH-IN FREEZER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 24 SLIM JIMS: 7 REQUIRED

A. Owner furnished and installed.

ITEM 25 HAND WASHING SINKS: 7 REQUIRED

A. Advance Tabco, model 7-PS-44 *H011. Include #7-PS-15 12" high stainless steel welded side splash shields.

B. Seal to wall.

ITEM 26 CUBE ICE MACHINE WITH STORAGE BIN: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 27 SUPPORT TABLE WITH SINK: 1 REQUIRED

A. Pacific Stainless Products, model PTS-6630C8L20S *H011 fully welded custom prep table with single sink. Sink table shall incorporate the following:

1. CHG Saniguard, model KL54-8008 splash mount faucet at sink
2. One Component Group, model DSS-8000 rotary waste assembly with 14-gauge stainless steel lever waste brackets welded to underside of sink compartments.
3. Sound deaden underside of top and sink compartments.

4. Model TMSC6614 table mount cantilever shelf. Install with 18-inch clearance from table top. Seal post penetrations in backsplash.
5. One model SDAS-202006S stainless steel drawer assembly as shown.

B. Install assembly complete. Clip and seal to wall.

ITEM 28 NOT USED

ITEM 29 NOT USED

ITEM 30 STAFF COMPUTER WORK STATION: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 31 VEGETABLE PREPARATION SINK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model TCS-2428-14-B30 *H011 fully welded custom “Spec Line” sink table in configuration per plan. Include the following accessories:

1. CHG Saniguard, model KL53-1000-AF8-BR spray rinse faucet with Add-on faucet. Include wall bracket. Install between sinks.
2. One CHG Saniguard, model KL54-8010 splash mount faucet.
3. Three CHG Saniguard, model DSS-8015 rotary waste assemblies with overflows.
4. 14” deep sinks.
5. Shelf under right drainboard.
6. Sound deaden underside of top and sink compartments.

B. Submit factory drawing for approval.

C. Install assembly complete. Clip and seal to wall.

ITEM 32 VEGETABLE PREPARATION SINK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model TCS-2428-14-B30 *H011 fully welded custom “Spec Line” sink table in configuration per plan. Include the following accessories:

1. CHG Saniguard, model KL53-1000-AF8-BR spray rinse faucet with Add-on faucet. Include wall bracket. Install between sinks.
2. One CHG Saniguard, model KL54-8010 splash mount faucet.
3. Three CHG Saniguard, model DSS-8015 rotary waste assemblies with overflows.
4. 14” deep sinks.
5. Shelf under left drainboard.
6. Sound deaden underside of top and sink compartments.

B. Submit factory drawing for approval.

C. Install assembly complete. Clip and seal to wall.

ITEM 33 FOOD PROCESSOR: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 34 MOBILE ISLAND WORK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKT-7230-IS *H011 fully welded table with the following accessories:

1. Two model SDAS-202006S stainless steel drawer assemblies as shown.
2. Model CHGC23-1451 casters with brakes.
3. Match length show on Sheet FS1.04.

B. Install assembly complete.

ITEM 35 UTILITY CARTS: 6 REQUIRED

A. Owner furnished and installed.

ITEM 36 MOBILE SLICER CARTS: 2 REQUIRED

A. Owner furnished and installed.

ITEM 37 SLICERS: 2 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 38 SPEED RACKS: 8 REQUIRED

A. Owner furnished and installed.

ITEM 39 MOBILE ISLAND WORK TABLES: 2 REQUIRED

A. Pacific Stainless Products, model WKS9630-IS*H011 fully welded table with the following accessories:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Provide full length stainless steel under shelf.

B. Install assembly complete.

ITEM 40 MEAT CUTTER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 41 FOOD CUTTER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 42 MOBILE FOOD CUTTER CART: 1 REQUIRED

A. Owner furnished and installed.

ITEM 43 NOT USED

ITEM 44 MAPLE TOP BAKER'S TABLE: 1 REQUIRED

A. Pacific Stainless, model WWKT-7230IS *H011. Include the following:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Provide full length stainless steel under shelf.

B. Install assembly complete.

ITEM 45 PREP TOP REFRIGERATOR: 1 REQUIRED

A. Delfield, model 4472N-18 *H011 with the following accessories:

1. Flat lift-off cover.
2. Door locks.
3. Interior lights.
4. Exterior thermometer.

B. Install assembly complete.

ITEM 46 ISLAND WORK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKT-7230-IS *H011 fully welded table with the following accessories:

1. Two model SDAS-202006S stainless steel drawer assemblies as shown.
2. Adjustable stainless steel flanged feet.
3. Match length show on Sheet FS1.04.

B. Install assembly complete.

ITEM 47 NOT USED

ITEM 48 NOT USED

ITEM 49 80-QUART MIXER: 1 REQUIRED

A. Hobart, model HL800 *H011. Provide with Standard Accessory Package.

ITEM 50 FILL FAUCET: 1 REQUIRED

A. Fisher, model 2250 *H011.

ITEM 51 SUPPORT TABLE WITH SINK: 1 REQUIRED

A. Pacific Stainless Products, model PTS-12030C8C24DS *H011 fully welded custom prep table with single sink. Sink table shall incorporate the following:

1. CHG Saniguard, model KL54-8008 splash mount faucet at sink

2. One Component Group, model DSS-8000 rotary waste assembly with 14-gauge stainless steel lever waste brackets welded to underside of sink compartments.
3. Sound deaden underside of top and sink compartments.
4. Model TMSC7814 table mount cantilever shelf aligned with left end of table. Install with 18-inch clearance from table top. Seal post penetrations in backsplash.
5. Stainless steel shelves below each drainboard.
6. One model SDAS-202006S stainless steel drawer assembly below right drainboard.

B. Install assembly complete. Clip and seal to wall.

ITEM 52 FOOD PROCESSOR: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 53 MEAT PREP SINK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model DCS-2424-14-B48(left)-B42(right) *H011 fully welded custom sink table. Sink table shall incorporate the following:

1. CHG Saniguard, model KL53-1000-AF8-BR spray rinse faucet with Add-on faucet. Include wall bracket. Install between sinks.
2. Two Component Group, model DSS-8000 rotary waste assemblies with 14-gauge stainless steel lever waste brackets welded to underside of sink compartments.
3. Sound deaden underside of top and sink compartments.
4. Provide under shelf and leg bracing as detailed.
5. Provide undershelves below right and left drainboards.

B. Install assembly complete. Clip and seal to wall.

ITEM 54 CANOPY HOOD WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

A. Halton, model KVC *H011 Capture Jet 18-gauge stainless steel island canopy hood. Refer to Factory File #U17-165. The hood shall incorporate the following:

1. UL listed damper assembly.
2. Supply air plenums.
3. MARVEL System with control panel to control this hood and Items 54, 72, and 85.
4. LED light fixtures as shown on Halton factory drawings. Furnish and install lamps.
5. Auto-Start Control panel.
6. Ansul Piranha Fire Protection System with Automan Regulated Release Assembly furnished and installed by Halton. Refer to factory drawings. Install in accordance with NFPA bulletin 96, including all current amendments to protect this hood including surface protection as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Halton. All contactors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation.
7. Include 18-gauge stainless steel removable closure panels and trim as required to seal hood to ceiling and walls. Verify ceiling height. Submit shop drawings prior to fabrication.

8. Install hood with 80” clearance from finished floor.

B. Exhaust and supply duct work and fans furnished and installed by Division 23.

ITEM 55 STAINLESS STEEL WALL FLASHING: 1 LOT REQUIRED

A. Fabricate 20-gauge stainless steel Number 4 finish wall flashing bonded to gypsum board with heat resistant mastic beginning directly above base tile on wall and terminating 2” above bottom edge of canopy hood. Flashing shall run full length of canopy hood and ends at wall returns.

B. Note: ceiling and wall flashing shall meet Mechanical Code Sections 507.4 and 507.9. Verify all requirements and provide flashing (insulated for 1-hour rating if required) to meet the codes.

C. Install flashing with no exposed fasteners or screws in interlocking sections of equal lengths. Verify that surfaces are flat and smooth with a maximum variation of 1/16” in 10 feet.

D. Install assembly complete.

ITEM 56 GRIDDLES WITH STANDS: 2 REQUIRED

A. Vulcan, model HEG60E *H011 with the following accessories:

1. Stainless steel stand with marine edges and casters.

B. Install assembly complete.

ITEM 57 FLOOR TROUGHS: 3 REQUIRED

A. Pacific Stainless, model FT4224-FG *H011 with fiberglass grate.

B. Coordinate exact location to best serve the equipment pour path and verify rough-in size prior to slab pour.

ITEM 58 40-GALLON TILTING SKILLETS: 2 REQUIRED

A. Vulcan, model VE40 *H011 with the following accessories:

1. Double pantry double-jointed faucet with mounting bracket.

B. Install assembly complete.

ITEM 59 FRENCH PLATE/FRY TOP RANGE: 1 REQUIRED

A. Vulcan, model EV36S-2FP24G208 *H011.

B. Install assembly complete.

ITEM 60 DOUBLE STACK CONVECTION STEAMERS: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 61 DOUBLE-STACK CONVECTION OVENS: 1 REQUIRED

A. Vulcan, model VC44ED *H011.

B. Install assembly complete.

ITEM 62 COOK'S SUPPORT TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKS9630-IS *H011 fully welded table with the following accessories:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Provide full length stainless steel under shelf.

B. Install assembly complete.

ITEM 63 BLENDER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 64 REACH-IN REFRIGERATOR: 1 REQUIRED

A. Owner furnished and installed.

ITEM 65 MOBILE WORK TABLES: 2 REQUIRED

A. Pacific Stainless Products, model WKS7230IS *H011 fully welded table with the following accessories:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Model TMSS7212P table mount over shelf.

B. Install assembly complete.

ITEM 66 MOBILE ISLAND WORK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKS9648IS *H011 special width fully welded table with the following accessories:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Provide full length stainless steel under shelf.

B. Install assembly complete.

ITEM 67 FLOOR TROUGHS: 2 REQUIRED

A. Pacific Stainless, model FT10224-FG *H011 with standard fiberglass grating.

B. Coordinate exact location to best serve the equipment pour path and verify rough-in size prior to slab pour.

ITEM 68 MOBILE ISLAND WORK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKS9630IS *H011 fully welded table with the following accessories:

1. One model SDAS-202006S stainless steel drawer assembly as shown.
2. Model CHGC23-1451 casters with brakes.
3. Provide full length stainless steel under shelf.

B. Install assembly complete.

ITEM 69 VEGETABLE CUTTER/SLICER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 70 ROLL-IN RACK OVEN WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

A. Baxter, model OV500E2 *H011 with the following accessories:

1. Grease filters for Type I application.
2. Ansul R-102-AREF Chemical Fire Protection System with Automan Regulated Release Assembly. Install in accordance with NFPA bulletin 96, including all current amendments to protect this oven as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Gaylord. All contractors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation. System control cabinet shall be installed in location shown.
3. Provide 18-gauge stainless steel all-welded grease tight round duct to 4" above finished ceiling. Verify diameter.

B. Field verify size access/conditions before ordering.

C. Install assembly complete.

D. Concealed exhaust duct work and fan furnished and installed by Mechanical Division.

ITEM 71 MOBILE OVEN RACKS: 8 REQUIRED

A. Baxter, model BSRSB-20A *H011.

ITEM 72 CANOPY HOOD WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

A. Halton, model KVC *H011 Capture Jet 18-gauge stainless steel island canopy hood. Refer to Factory File #U17-165. The hood shall incorporate the following:

1. UL listed damper assembly.
2. Supply air plenums.

3. Refer to Item 54 for MARVEL system.
4. LED light fixtures as shown on Halton factory drawings. Furnish and install lamps.
5. Auto-Start Control panel.
6. Ansul Piranha Fire Protection System with Automan Regulated Release Assembly furnished and installed by Halton. Refer to factory drawings. Install in accordance with NFPA bulletin 96, including all current amendments to protect this hood including surface protection as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Halton. All contactors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation.
7. Include 18-gauge stainless steel removable closure panels and trim as required to seal hood to ceiling and walls. Verify ceiling height. Submit shop drawings prior to fabrication.
8. Install hood with 80" clearance from finished floor.

B. Exhaust and supply duct work and fans furnished and installed by Division 23.

ITEM 73 STAINLESS STEEL WALL FLASHING: 1 LOT REQUIRED

A. Fabricate 20-gauge stainless steel Number 4 finish wall flashing bonded to gypsum board with heat resistant mastic beginning directly above base tile on wall and terminating 2" above bottom edge of canopy hood. Flashing shall run full length of canopy hood and ends at wall returns.

B. Note: ceiling and wall flashing shall meet Mechanical Code Sections 507.4 and 507.9. Verify all requirements and provide flashing (insulated for 1-hour rating if required) to meet the codes.

C. Install flashing with no exposed fasteners or screws in interlocking sections of equal lengths. Verify that surfaces are flat and smooth with a maximum variation of 1/16" in 10 feet.

D. Install assembly complete.

ITEM 74 DOUBLE-STACK CONVECTION OVENS: 3 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 75 ROLL-IN COMBI-OVEN STEAMERS: 2 REQUIRED

A. Alto-Shaam, model CTP20-20E *H011 Proformance Combitherm with the following accessories:

1. Window door.
2. Door lock with key.
3. Full perimeter bumper.
4. Factory recommended water filtration system.

B. Install assembly complete.

ITEM 76 TWO 6-GALLON TILTING KETTLES WITH STAND: 1 REQUIRED ***[Addendum 3]***

A. Cleveland, model 36-EM-K66-24 *H011 with the following accessories:

~~1. 2-inch tangent draw-off valve with strainer.~~
2. Kettle accessory kit.
3. Console mount ¾" double pantry fill faucet with swing spout and sprayer hose.
~~4. Spring assist hinged stainless steel cover.~~
5. Food and drain strainers.
~~6. Measuring strip.~~

B. Install assembly complete.

ITEM 77 100-GALLON STATIONARY KETTLES: 2 REQUIRED ***[Addendum 3]***

A. Cleveland, model KEL-100~~-SH~~ *H011 with the following accessories:

1. 2-inch tangent draw-off valve with strainer.
2. Kettle accessory kit.
3. Console mount ¾" double pantry fill faucet with swing spout and sprayer hose.
4. Lift-off stainless steel cover.
5. Food and drain strainers.
6. Measuring strip.

B. Install assembly complete.

ITEM 78 100-GALLON COOKER/MIXER KETTLE: 1 REQUIRED

A. Cleveland, model MKEL-100-T *H011 with the following accessories:

1. 2-inch tangent draw-off valve with strainer.
2. Kettle accessory kit.
3. Console mount ¾" double pantry fill faucet with swing spout and sprayer hose.
4. Lift-off stainless steel cover.
5. Food and drain strainers.
6. Measuring strip.
7. Model MFS Pump metering filling station.

B. Install assembly complete.

ITEM 79 BLAST CHILLER RACKS: 40 REQUIRED

A. Owner furnished and installed.

ITEM 80 ROLL-IN BLAST CHILLERS: 4 REQUIRED ***[Addendum 3]***

A. (1) is future equipment.

B. ***American Panel*** HurriChill, model ***AP24BC250-3*** ~~AP80BC700-3~~ *H011. ***Include the following:***

1. ***USB HACCP Interface.***
2. ***(4) Non-Heated probes (turn over to Owner for back-up).***

C. Install assembly complete.

ITEM 81 BEVERAGE TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKS7236-A6S *H011 fully welded custom prep table. Table shall incorporate the following:

1. Sound deaden underside of top and sink compartments.
2. Model TMSC3614 table mount cantilever shelf; align with right end of table. Install with 18-inch clearance from table top. Seal post penetrations in backsplash.
3. One model SDAS-202006S stainless steel drawer assembly as shown.
4. Left end splash.

B. Install assembly complete. Clip and seal to walls.

ITEM 82 SODA DISPENSER: 1 REQUIRED

A. Vendor furnished and installed, freestyle.

ITEM 83 MEAL TRANSPORT CARTS: 64 REQUIRED

A. Owner furnished and installed.

ITEM 84A TRAY LINE MOBILE STARTER TABLES: 4 REQUIRED

A. Eagle Group, model T30488E-HA-L/R *H011.

ITEM 84B TRAY LINE COLD DISH-UP WELLS: 4 REQUIRED

A. Turbo Air, model JBT-72 *H011 with the following accessories:

1. Model M726500200 5" casters with brakes.
2. Model SNZ-72 sneeze quard.
3. Model TS-72 tray slide.

B. Install assembly complete.

ITEM 84C TRAY LINE TRAY LOWERATOR CARTS: 4 REQUIRED

A. Lakeside, model 217 *H011.

ITEM 84D TRAY LINE SLIDER TABLES: 16 REQUIRED

A. Burlodge, model B2-ST-M-2330 *H011.

ITEM 84E TRAY LINE MOBILE GRAB 'N GO SHELVING: 12 REQUIRED

A. InterMetro, model QB4874-1A *H011 qwikSIGHT single sided shelf system with casters. Include the following:

1. Include four (4) 12” x 18” QB1218B baskets per tier.
2. Start baskets 36” above finished floor.

3. ***Four (4) model QB48 4" diameter casters with brakes. [Addendum 3]***

B. Install assembly complete.

ITEM 85 CANOPY HOOD WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

F. Halton, model KVC *H011 Capture Jet 18-gauge stainless steel island canopy hood. Refer to Factory File #U17-165. The hood shall incorporate the following:

1. UL listed damper assembly.
2. Supply air plenums.
3. Refer to Item 54 for MARVEL system.
4. LED light fixtures as shown on Halton factory drawings. Furnish and install lamps.
5. Auto-Start Control panel.
6. Ansul Piranha Fire Protection System with Automan Regulated Release Assembly furnished and installed by Halton. Refer to factory drawings. Install in accordance with NFPA bulletin 96, including all current amendments to protect this hood including surface protection as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Halton. All contactors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation.
7. Include 18-gauge stainless steel removable closure panels and trim as required to seal hood to ceiling and walls. Verify ceiling height. Submit shop drawings prior to fabrication.
8. Install hood with 80" clearance from finished floor.

G. Exhaust and supply duct work and fans furnished and installed by Division 23.

ITEM 86 TRAY CART DOCKING STATIONS: 18 REQUIRED

A. Owner furnished and installed.

ITEM 87 SECURE CHEMICAL STORAGE SHELVING: 1 LOT REQUIRED

A. Owner furnished and installed.

ITEM 88 DISPOSER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 89 POTWASHING SOILED DISHTABLE: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 90 VAPOR EXHAUST DUCTS: 2 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 91 POT/PAN WASHER AND BOOSTER HEATER: 1 REQUIRED

A. Hobart, model CLPS86eN-EGR *H011 with 30KW booster heater for left to right/right to left operation. Include the following:

1. Model CLPS86eN-EGRHTE15K 15KW electric tank heater.
2. Model BDELRAX-HTSDOM blower-dryer.
3. Single point electrical connection.
4. 6-inch higher than standard chamber.
5. Table limit switch.

B. Install assembly complete.

ITEM 92 BLOWER/DRYER: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 93 CLEAN DISHTABLE: 1 REQUIRED

A. Existing equipment. Relocate and reinstall in location shown.

ITEM 94 NOT USED

ITEM 95 EYE WASH STATION: 1 REQUIRED

A. Specified by Plumbing Division.

ITEM 96 HIGH PRESSURE WASH SYSTEM: 1 REQUIRED

A. Spray Master Technologies, model 600REY *H011 rack mounted central system with four (4) remote ports.

ITEM 97 MOBILE WASTE RECEPTACLES: 10 REQUIRED

A. Owner furnished and installed.

ITEM 98 TROUGH WASTE COLLECTOR: 1 REQUIRED

A. Salvajor, model S419 *H011 trough collector with the following accessories:

1. Additional scrap basket.
2. Trough inlet and two rubber gusher heads equally spaced along trough length.

B. Install assembly complete in Item 102 Soiled Dishtable.

ITEM 99 MOBILE DISH CARTS: 2 REQUIRED

A. Owner furnished and installed.

ITEM 100 FLOOR TROUGHS: 3 REQUIRED

A. Pacific Stainless, model FT12012-FG *H011 with fiberglass grate.

B. Coordinate exact location to best serve the equipment pour path and verify rough-in size prior to slab pour.

ITEM 101 VAPOR EXHAUST DUCTS: 2 REQUIRED

A. Fabricate two 18-gauge stainless steel steam tight exhaust ducts as detailed and connect to stainless steel vent stacks furnished with Warewasher, Item 102. Extend each duct 4 inches above finished ceiling and trim with stainless steel at ceiling penetrations. Seal all gaps at trim.

B. Exhaust fan furnished and installed under Division 23.

ITEM 102 OVAL WAREWASHER WITH DISHTABLES: 1 REQUIRED

A. Stero, model ER-94S *H011 three tank conveyorized dishwasher with 27KW booster heater for right to left operation. Dishwasher includes power scrapper, power wash, power rinse, and high temperature final rinse. Include the following:

1. Electric tank booster heater.
2. Cold water aquastat.
3. Vent cowl.
4. Circuit breakers.
5. Shudown timer, rinse activated.
6. 3-inch higher than standard chamber.
7. Table limit switch.
8. Factory inter-plumbing of booster heater.

B. Provide one (1) TragenFlex Soiled Breakdown System *H011 as shown on TragenFlex drawings P178287-01 and P178287-03. System consists of:

1. One (1) TragenFlex, model SDT *H011 Soiled Dish Table. Include the following:

a. Provide NSF Listed Soiled Dish Table, 14-gauge stainless steel top and trough as shown on plan. Table shall be formed with vertical and horizontal corners coved to a 3/4” radius. Provide one (1) magnetic silver, two (2) perforated stainless steel ledges, and (2) pre- rinse sprays with mixing valves.
b. Trough shall be 10” wide sloping from 3” to maximum with matching at the scrap accumulator mounted in the end of the trough. Furnish trough with connection for trough gusher for water line. TragenFlex to provide water line mounted under waste trough from end of trough to scrap accumulator.
c. Provide 9’-3” long overhead rack and storage shelf.
d. Support table on 1-5/8” diameter stainless steel legs with adjustable stainless steel flanged feet to be anchored with 3/8" bolts. Legs shall be positioned to align up front-to-back for maximum access for cleaning. Legs shall be supported with 12-gauge stainless steel leg channels. All cross rails shall be fully welded to legs with all welds polished and ground smooth.
e. Connection: 1/2” diameter hot and cold water (2 places); where shown on plan.

2. One (1) TragenFlex, model KBC-200 *H011 Knuckle Belt Rack Transfer Conveyor.

a. Provide Knuckle Belt Rack Transfer Conveyor as shown on plan. Unit shall be TragenFlex Model KBC-200, speed to match speed of dish machine, using an AC

Inverter for varying the speed. Conveyor to form an integral part of scrapping table and purpose of conveyor to carry standard 20" x 20" racks directly into rack-style dish machine.

b. Knuckle belt shall be equal to a pivot-radius, or multi-flex chain as used in commercial food plant operations.
c. Connection: 1/2" diameter hot and cold water (1 place); where shown on plan.
d. Connection: 1-1/2" drain (1 place); where shown on plan.
e. Control System

1) Provide UL Listed Main Control Center for Knuckle Belt Rack Transfer Conveyor containing main disconnect, start-stop, speed control, and indicating lights. All components shall be neatly contained in a stainless steel watertight enclosure. All wiring shall conform to the latest UL standards. The electrical contractor shall bring 208V/1phase/15A to the main of the panel, but wiring from the equipment to this panel shall be done by TragenFlex and all wiring shall be carried in liquid tight conduits, including conveyor motor and controls. All electrical controls shall be approved for wet conditions and shall comply with all applicable codes. All enclosures for electrical components must be watertight.

f. Slide Bed

1) Provide 14-gauge stainless steel bed formed with vertical and horizontal corners coved to a 1/4" radius. Unit shall be reinforced with channel mounted on 1-5/8" diameter tubular stainless steel legs with adjustable bullet feet and rails. Edges of table to be 2" standard boxed around Knuckle Belt Conveyor.

g. Installation & Warranty

1) TragenFlex shall be responsible for all interconnections of Electrical work required for conveyor system. Final connections to building services shall be by others. TragenFlex shall install and adjust system to owner's satisfaction and shall provide adequate instructions to operating personnel. System shall be guaranteed for a period of one year for parts and labor under normal operating Plumbing interconnections shall be by K.E.C.

3. One (1) TragenFlex, model GRC *H011 Clean Dish Roller Table.

a. Provide NSF listed Clean Dish Table, 14-gauge stainless steel formed with vertical and horizontal corners coved to a 3/4" radius.
b. Table to be equipped with turned up sides with hem edge 2" above top of roller on both sides. Table to be connected to exit end of dishmachine to provide a drip-proof connection. Slope table to drain, built into table where shown on plan. Table shall be designed to accept a gravity roller conveyor to carry dish racks from dish machine smoothly & designed to help the drip drying of racks.
c. Gravity roller conveyor shall be in accordance with the following:

1) Rollers shall be 1.9" diameter blue PVC, fitted with polypropylene bearings with stainless steel balls. Rollers shall be spaced at approximately 5-1/2" centers. Shafts shall be 7/16" hexagon aluminum securely bolted to side

rails. Side rails shall be 1/8" x 2" stainless steel resting on support pins welded to side of conveyor bed to keep rollers elevated above bottom of bed for effective draining of water from dish racks. At exit of dishmachine, first three (3) rollers shall be stainless steel tubing construction. Table to be supported on 1-5/8" diameter stainless steel legs with adjustable stainless steel flanged feet to be anchored with 3/8" bolts. Legs shall be supported on 12-gauge stainless steel leg channels. All cross rails to be fully welded to legs with all welds polished and ground smooth. Provide a pre-wired accumulation switch at end of clean table integrated with dish machine to shut machine off when a rack reaches the end of the table.

d. Connection: 1-1/2" drain (1 place); where shown on plan.

4. One (1) Advance Tabco, model DI-1-25 Hand Sink *H011.

   a. Provide one (1) hand sink as shown on drawing. Sink to form an integral part of scraping table.
   b. Connection: 1/2" diameter hot and cold water (1 place); where shown on plan.
   c. Connection: 1-1/2" drain (1 place); where shown on plan.

5. One (1) TragenFlex, model HRA-30 *H011 Retractable Hose Reel.

   a. Provide one (1) retractable hose reels as shown on drawing. Assembly shall include 30'-0" heavy duty dairy-quality hose and heavy duty front trigger style water gun and hot and cold mixing valves.
   b. Provide 14-gauge stainless steel bracket mounted under soiled dish table.
   c. Connection: 1/2" diameter hot and cold water (1 Place); where shown on plan.

6. One (1) TragenFlex, model SS2323 *H011 Mobile Soak Sink.

   a. Provide one (1) Mobile Soak Sink where shown on plan. Unit shall measure 23" x 23" x 24" high x 8" deep sink and shall be mounted on 1-5/8" diameter stainless steel legs and 5" heavy-duty casters. Sink shall be formed of 14-gauge stainless steel with all corners coved to 5/8" radius. Provide rolled rims on all top edges and lever-operated 1-1/2" waste with open drain.

C. Install assembly complete.

ITEM 103 MOBILE TRAY DRYING RACKS: 3 REQUIRED

A. Owner furnished and installed.

ITEM 104 DEHYDRATOR: 1 REQUIRED

A. Future equipment.

B. Champion, model PHX-250 *H011 Phoenix dehydrator.

ITEM 105 NOT USED

ITEM 106 HOSE REEL: 1 REQUIRED

A. Fisher, model 29602 *H011 with 50-foot hose.

ITEM 107 AIR CURTAINS: 2 REQUIRED

A. Berner, model SLC07-1060A-A-SS *H011 with plunger switch to ensure unit is automatically activated when door is opened.

ITEM 108 NOT USED

ITEM 109 NOT USED

PART 3 - EXECUTION

3.1 SUPERVISION:

A. A competent supervisor, representing the Kitchen Equipment Contractor (KEC), shall be present at all times during progress of the Kitchen Equipment Contractor (KEC)'s work.

3.2 SITE EXAMINATION:

A. Verify site conditions under the provisions of the General Conditions, Supplementary Conditions and applicable provisions of Division 1 Sections. Notify the Architect, in writing, of unsatisfactory conditions for proper installation of food service equipment.

B. Verify wall, column, door, window, and ceiling locations and dimensions. Fabrication and installation should not proceed until dimensions and conditions have been verified and coordinated with fabrication details.

C. Verify that wall reinforcement or backing has been provided, and is correct for wall supported equipment. Coordinate placement dimensions with wall construction Section.

D. Verify that ventilation ducts are of the correct characteristics, and in the required locations.

E. Verify that utilities are available, of the correct characteristics, and in the required locations.

3.3 INSTALLATION:

A. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

B. Install items in accordance with manufacturer's instructions.

C. Set each item of non-mobile and non-portable equipment securely in place, leveled and adjusted to correct height. Anchor to supporting substrate where indicated, and where required for sustained operation and use without shifting or dislocation. Conceal anchorages wherever possible. Adjust counter tops and other work surfaces to a level tolerance of 1/16 inch (maximum offset, and plus or minus on dimension, and maximum variation in 2'-0" run from level or indicated slope). Provide anchors, supports, bracing, clips, attachments, etc., as required to comply with the local seismic restraint requirements. The Guidelines For Seismic Restraint of Kitchen Equipment, as prepared for the Sheet Metal Industry Fund of Los Angeles and endorsed by SMACNA, should be followed.

D. Complete field assembly joints in the work (joints which cannot be completed in the shop) by welding, bolting-and-gasketing, or similar methods as indicated and specified. Grind welds smooth and restore finish. Set or trim flush, except for "T" gaskets as indicated.

E. Provide closure plates and strips where required, with joints coordinated with units of equipment.

F. Provide sealants and gaskets all around each unit to make joints airtight, waterproof, vermin-proof, and sanitary for cleaning purposes.

G. Joints up to 3/8-inch-wide will be stuffed with backer rod to shape sealant bead properly, at 1/4 inch depth.

H. At internal corner joints, apply sealant or gaskets to form a sanitary cove of not less than 3/8-inch radius.

I. Shape exposed surfaces of sealant slightly concave with edges flush with faces of materials at joint.

J. Provide sealant filled or gasketed joints up to 3/8-inch joint width. Wider than 3/8 inch, provide matching metal closure strips, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.

K. Treat enclosed spaces, inaccessible after equipment installation, by covering horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.

L. Insulate to prevent electrolysis between dissimilar metals.

M. Cut and drill components for service outlets, fixtures, piping, conduit, and fittings.

N. Coordinate the installation of approved dry pendant sprinkler head in each cooler and freezer. Sprinkler heads should be installed in coolers/freezers only if required by local codes.

O. Verify and coordinate the mounting heights of all wall shelves and equipment, with equipment located below them for proper clearances.

P. Coordinate with the Plumbing and Electrical Divisions and provide holes in food service equipment for plumbing and electrical service to and through the fixtures, as required. This includes welded sleeves, collars, ferrules, or escutcheons. Locate these services so that they do not interfere with intended use and/or servicing of the fixture. No alterations of the building are allowed without written permission by the General Contractor and/or Architect. (i.e. – routing refrigerant lines).

3.4 ADJUSTING:

A. Test and adjust equipment, controls and safety devices to ensure proper working order and conditions.

B. Repair or replace equipment which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

3.5 CLEANING AND RESTORING FINISHES:

A. After completion of installation and completion of other major work in food service areas, remove protective coverings and clean food service equipment internally and externally.

B. Restore exposed and semi-exposed finishes, to remove abrasions and other damages, polish exposed metal surfaces and touch-up painted surfaces. Replace work, which cannot be successfully restored.

C. Polish glass, plastic, hardware and accessories, fixtures and fittings.

D. Wash and clean equipment and leave in a condition ready for the Owner to sanitize and use.

3.6 TESTING, START-UP AND INSTRUCTIONS:

A. Delay the start-up of equipment until service lines have been tested, balanced, and adjusted for pressure, voltage and similar considerations and until water and steam lines have been cleaned and treated for sanitation.

B. Plan for demonstration of food service equipment operation and maintenance in advance with the Owner/Operator. Training shall include a total of 16 hours in four (4) 4-hour sessions. Owner shall video tape training sessions.

C. Demonstrate food service equipment to familiarize the Owner and the Operator on operation and maintenance procedures, including periodic preventative maintenance measures required. Include an explanation of service requirements and simple on-site service procedures as well as information concerning the name, address and telephone number of qualified local source of service. The individual performing the demonstration shall be knowledgeable of operating and service aspects of the equipment. Provide Owner with factory equipment training videos for all equipment that requires training for proper operation.

D. Provide a written report of the demonstration to the Owner, outlining the equipment demonstrated and malfunctions or deficiencies noted. Indicate individuals present at demonstration.

E. Final Cleaning: After testing and start-up, clean the food service equipment and leave in a condition ready for the Owner to sanitize and use.

3.7 CLEAR AWAY:

A. Throughout the progress of their work, the Kitchen Equipment Contractor (KEC) shall keep the working area free from debris and shall remove rubbish from premises resulting from work being done by them. At the completion of their work, the Kitchen Equipment Contractor (KEC) shall leave the premises in a clean and finished condition.

3.8 COMMISSIONING OF EQUIPMENT

A. Applies to 1) Walk-in Coolers and Freezers and 2) Kitchen Hood Systems: Selected Division 11 equipment and systems referenced are to be commissioned per Section 01 91 13 – General Commissioning Requirements and Section 11 08 00, Commissioning of Conveying Equipment. The contractor has specific responsibilities for schedule, coordination, startup, test development, testing, and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 114000

SECTION 117100 – MEDICAL PROCESSING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes coordination with third-party vendor for delivery and installation of Owner Furnished and Vendor Installed (OFVI) medical processing equipment.

B. Related Sections:

1. Divisions 22-23 Sections for plumbing and mechanical utility rough-in work.
2. Division 26 Sections for electrical utility rough-in work.

1.3 SUBMITTALS

A. Rough-In Drawings:

1. Submit electronic PDF file for approval.
2. These drawings shall be dimensioned from grid lines showing location of ducts, stubs, floor and wall sleeves for ventilation, plumbing, electrical, and related dimensions as required for equipment so supported.
3. Site-verify mechanical, electrical and ventilating rough-in and sleeve locations.

1.4 PRE-INSTALLATION CONFERENCE

A. Arrange, in accordance with Division 01 Section “Project Meetings.”

B. Attendance: Contractor, Vendor/Installer, Owner, Architect, and as requested to attend.

C. Arrange conference and job walk-through, minimum 2 weeks prior to completion of under slab-on-grade utility work of this Section.

1.5 PRODUCT HANDLING AND PROTECTION

A. Delivery and Storage: The Contractor shall be responsible for receiving and warehousing of equipment until ready for installation.

1. Coordinate requirements with equipment manufacturer.
2. Receive equipment at a loading dock with capacity for non-power tailgate delivery.
3. Receive and inspect new equipment with the Owner’s representative for damage and store in weather-protected, secure area inside Building 22.

B. Handling Materials and Equipment: Verify and coordinate conditions at the building site, particularly door and/or wall openings and passages to assure access for all equipment.

C. Protect the equipment against theft and damage during the progress of the project until final acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MEDICAL PROCESSING EQUIPMENT (Owner Furnished, Vendor Installed)

A. Equipment Type CS01 – STERIS Corporation / Model CCPS3110835AH
106" Triple Bay Stainless Steel Clean-up Sink, adjustable height.
B. Equipment Type CS02 – STERIS Corporation / Model CCPS317235
72" Single Bay Stainless Steel Clean-up Sink, fixed height.
C. Equipment Type CS03 – STERIS Corporation / Model CR115
Caviwave Ultrasonic Cleaner, 15 Gallon.
D. Equipment Type CS04 – STERIS Corporation / Model CRT5A
Reliance Table Top Ultrasonic Cleaner, 5.75 Gallon.
E. Equipment Type CS05 – STERIS Corporation / Model FH14043
Amsco Washer Disinfector 5052.
F. Equipment Type CS06 – STERIS Corporation / Model CG71005
Pass-Thru Window with set down counter.
G. Equipment Type CS07 – STERIS Corporation / Model CG51
Work Table Base, positionable.
H. Equipment Type CS08 – STERIS Corporation / Model SR2222213011
Amsco 400 Medium Steam Sterilizer, recessed.
I. Equipment Type CS10 – STERIS Corporation / Model CH10861
100 KW Electric Steam Sterilizer.
J. Equipment Type CS11 – STERIS Corporation / Model AW00HCS2052
AmeriWater RO2 System with high flow pump and 100 gallon tank.
K. Equipment Type CS12 – Thermo Fisher / Barnstad E-Pure Model D4631
Ultra-Pure Water Filtration System.
L. Equipment Type CS13 – STERIS Corporation / Model
Chemistry Dispenser, wall mounted.
M. Equipment Type PH01 – BD Pyxis / Model C^{II} Safe Main
C^{II} System Double Column Integrated Main Unit.
N. Equipment Type PH02 – BD Pyxis / Model C^{II} Safe Auxiliary
C^{II} System Double Column Auxiliary Unit.
O. Equipment Type PH03 – BD Pyxis / Model C^{II} Printer
C^{II} System Printer.
P. Equipment Type PH06 – BD Pyxis / PAR_X System Workstation
Medication Inventory System Workstation and Monitor.
Q. Equipment Type PH09 – BD Pyxis / MedStation 4000
2-Drawer MedStation Cabinet.
R. Equipment Type PH10 – Nuaire Inc / NU-201-436
Horizontal Laminar Airflow Workstation.
S. Equipment Type PH11 – Nuaire Inc / NU-540-400 (future equipment)
Class II, Type A2 Biological Safety Cabinet.
T. Equipment Type PH15 – BD Pyxis / System Server
Medication Inventory System Server.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare site to enable equipment installation according to the construction documents and the Vendor equipment drawings/technical documentation to include walls, floors, drains, ceilings, building utility connections, including steam drip-legs and pressure regulators.
B. Assure that all door openings, hallways and areas in route from receiving area to installation site are clear and will accept equipment without dismantling equipment or removing/modifying any door frames, ceilings, cabinets or other facility structures. Provide floor protection.
C. Furnish and install electrical disconnects and final termination to Vendor equipment, coordinate locations with Vendor.
D. Furnish and install shutoff valves below finished ceiling and within reach for service shutdown, coordinate locations with Vendor.
E. Provide adequate lighting in equipment service areas for installation.
F. Provide adequate service area around equipment, disconnects, and shutoff valves as specified in Vendor equipment drawings and in accordance with local/state/federal codes.
G. Vendor will require a minimum two (2) weeks' notice prior to beginning actual installation work, with clear access to final equipment locations.

3.2 CLEANING

A. The Vendor will be responsible for cleanup of all packing materials, crates, crating and/or other debris of transporting/setting up the equipment, but containers/dumpsters must be provided by the Contractor.

END OF SECTION 117100

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Motor-operated roller shades with single rollers.

B. Related Requirements:

1. Division 06 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section. This includes but is not limited to all required extrusions, accessories, controls and fabricated roller shades.

B. Installer Qualifications: Engage an installer, which shall assume responsibility for installation of all system components, with the following qualifications.

1. Installer for roller shade system shall be trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Requirements for Electronic Hardware, Controls, and Switches:

1. Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.

D. Product Schedule: For roller shades.

1.5 \CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

A. Warranty: Provide manufacturer’s standard warranties, including the following:

1. Roller Shade Hardware, and Shadecloth: Manufacturer’s standard non-depreciating twenty-five year limited warranty.
2. Electronic Roller Shade EDU’s and EDU Control Systems: Manufacturer’s standard non-depreciating five-year warranty.
3. Roller Shade Installation: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

B. Basis of Design: Motorized Electro 3 as manufactured by MechoSystems, 718-729-2020, www.mechosystems.com. Subject to compliance with requirements, provide the named product or another product that has been approved prior to bid.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Drive Unit (EDU): Manufacturer's standard tubular, enclosed in roller with built-in reversible capacitor.

    a. Electrical Characteristics: 120VAC/60Hz, (230VAC/50Hz) single phase, temperature Class B, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each EDU..
    b. Maximum Total Shade Width: As required to operate roller shades indicated.
    c. Maximum Shade Drop: As required to operate roller shades indicated.
    d. Maximum Weight Capacity: As required to operate roller shades indicated.

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:

    a. Individual/Group Control Station: Maintained-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.

4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
5. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.

b. Capable of accepting input from building automation control system.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

a. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:

1) Hembar shall be heat sealed on all sides.
2) Open ends shall not be accepted.

b. Shade Band and Shade Roller Attachment:

1) Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
2) Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a “snap-on” snap-off” spline mounting, without having to remove shade roller from shade brackets.
3) Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
4) Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

2. Shadeband Material:

a. Basis of Design Product: MechoSystems, ThermoVeil® group, single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer’s available range.

1) Dense Basket Weave: "1300 series", 5 percent open, 2 by 2 dense basket-weave pattern.
2) Color as selected by Architect.

E. Installation Accessories:

1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open.
b. Provide "Vented Pocket" such that there will be a minimum of four 1 inch diameter holes per foot allowing the solar gain to flow above the ceiling line..

2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system**,** and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: At all south and east facing exterior windows, storefront, or curtainwall, excluding vestibules and lounges.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123570 - HEALTHCARE CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel healthcare casework.
2. Cabinet hardware.
3. Glazing

B. Related Requirements:

1. Division 9 Section "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring healthcare casework.

1.3 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of healthcare casework.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For healthcare casework.

1. Include plans, elevations, sections, and attachments to other work, including locations of blocking and reinforcements required for installation.
2. Show fabrication details, including types and locations of hardware.
3. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
4. Include coordinated dimensions for equipment specified in other Sections.
5. Indicate manufacturer's catalog numbers for casework.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.6 FIELD CONDITIONS

A. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Provide allowance for trimming

at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

B. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain from single source from single manufacturer.

B. Product Designations: Drawings indicate sizes and configurations of healthcare casework by referencing designated manufacturer's catalog numbers. Other manufacturers' metal healthcare casework of similar sizes, of similar door and drawer configurations, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."

C. Quality Standard Manufacturer and Product: Series 7 stainless steel cabinets as manufactured by Carr Corporation, 800-952-2398, www.carrcorporation.com

1. Type SS1 Base Cabinets: Carr 7302-30S 2-door stainless steel cabinet with glass doors and stainless steel marine edge countertop. Nominal dimensions 30 inches wide x 24 inches deep x 36 inches tall.
2. Type SS2 Base Cabinets: Carr 7302-36S 2-door stainless steel cabinet with glass doors and stainless steel marine edge countertop. Nominal dimensions 36 inches wide x 24 inches deep x 36 inches tall.
3. Type SS3 Base Cabinets: Carr 7321-24S 6-drawer stainless steel cabinet with stainless steel marine edge countertop. Nominal dimensions 24 inches wide x 24 inches deep x 36 inches high.
4. Type SS4 Sink Cabinet: Carr 7334-30S 2-door stainless steel base cabinet with stainless steel marine edge countertop with integral stainless steel sink. Nominal dimensions 30 inches wide x 24 inches deep x 36 inches high.
5. Type SS5 Recessed Full Height Wall Cabinet: Carr 7358-36S 2-door stainless steel cabinet with glass doors. Nominal dimensions 36 inches wide x 18 inches deep x 83 inches tall.

D. Acceptable Alternative Manufacturers and Products: Products equivalent in quality, dimensions, and features may be provided by one of the following manufacturers:

1. Continental Metal Products, 800-221-4439, www.continentalmetal.com
2. Southwest Solutions Group, 800-803-1083, www.southwestsolutions.com
3. *Custom Stainless Products, Inc. (Addendum 3)*

2.2 STAINLESS STEEL HEALTHCARE CASEWORK

1. Stainless Steel Sheet: ASTM A 240/A 240M, Type 304, stretcher-leveled standard of flatness.
2. Nominal Stainless Steel Thicknesses:

a. Sides, Ends, Fixed Backs, Bottoms, Cabinet Tops, Soffits, and Items Not Otherwise Indicated: 0.050 inch. Bottoms may be 0.038 inch if reinforced.
b. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.038 inch except 0.050 inch for unreinforced shelves more than 36 inches long.
c. Intermediate Horizontal Rails, Center Posts, Tubular Legs, and Top Gussets: 0.062 inch.
d. Drawer Runners and Hinge Reinforcements: 0.078 inch.
e. Leveling and Corner Gussets: 0.109 inch.

2.3 GLAZING

A. Tempered Glass: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

2.4 CASEWORK HARDWARE

A. Provide healthcare casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

2.5 CASEWORK FABRICATION

A. General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Integrally frame and weld to form a dirt- and vermin-resistant enclosure. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.

B. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

C. Hinged Doors: Mortise doors for hinges and reinforce with angles welded inside inner pans or hollow-metal stiles at hinge edge.

D. Metal Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.

E. Metal Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

F. Shelf Supports: Provide clips, brackets, pilasters, or other means to support shelves from cabinet ends and to allow height of shelves to be adjusted in increments of not more than 2 inches.

G. Toe Space: Unless casework is fully recessed, provide metal toe space, fully enclosed, 4 *6 (Addendum 3)* inches high by 3 inches deep, with no open gaps or pockets.

H. Filler Strips: Provide as needed to close spaces between casework and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as casework and with hemmed or flanged edges.

I. Trim Flanges: Formed metal trim fabricated from same material and with same finish as casework. Provide at perimeter of recessed cabinets.

2.6 STAINLESS STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional-satin finish matching ASTM A 480/A 480M, No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. ~~When polishing is completed, passivate and rinse surfaces.~~ *(Addendum 3)* Remove embedded foreign matter and leave surfaces clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of healthcare casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF HEALTHCARE CASEWORK

A. Install casework level, plumb, and true in line; shim as required using concealed shims. Where healthcare casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

B. Recessed Cabinets: Set cabinets in openings and fasten to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

C. Base Cabinets: Fasten cabinets to partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 16 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through the back, near the top, at not less than 16 inches o.c. unless continuously hung from hanging strips.

E. Install door and drawer hardware uniformly and precisely.

F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish as approved by Architect.

END OF SECTION 123570

SECTION 124813- ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Entrance / walk-off mats.

B. Related Sections include the following:

1. Division 01 Section “Sustainable Requirements.”
2. Division 03 Section "Cast-in-Place Concrete" for coordination of recesses to accept entrance mat systems.
3. Division 32 Section “Concrete Paving” for coordination of recesses to accept entrance mat systems.

C. The materials in this Section are part of the overall requirements to comply with the performance and submittal requirements of the LEED Green Building Rating System.

1.3 SUBMITTALS

A. Product data for each type of product specified, consisting of manufacturer's specification, technical data, and installation instructions.

B. Shop Drawings: Shop drawings showing layout, fabrication and installation of each product, including anchorage details, rough-in details. Show the following:

1. Carpet tile type, color, and dye lot.
2. Type of subfloor.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Installation method (monolithic, quarter turn, ashlar, brick random, interactive patterning).
7. Type, color, and location of insets and borders.
8. Type, color, and location of edge, transition, and other accessory strips.
9. Transition details to other flooring materials.

C. Samples: Full size sample

D. Maintenance data.

1.4 LEED SUBMITTAL REQUIREMENTS

A. Complete the LEED Materials Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

B. Cut sheets or other documentation for each product/material highlighting recycled content information.

C. Cut sheets or other documentation for each product/material highlighting location of manufacture and harvest/extraction if within 500 miles of the project.

D. Complete the LEED VOC Submittal Form as provided in Division 01 Section "Submittal Procedures" for products in this section.

E. Cut sheets or MSDS from product manufacturer for each adhesive, sealant, paint and coating project used within the vapor barrier, highlighting the VOC content.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats through one source from a single manufacturer.

B. Manufacturer Qualifications: Carpet manufacturer shall have no less than 5 years experience of producing recyclable carpet tile and shall have published product literature clearly indicating compliance with requirements of this section.

1. Certification: ISO 9001 and ISO 14001 certified manufacturer.

C. Installer Qualifications: An installer with a minimum of 5 years commercial carpet installation experience, and who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

D. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.6 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with carpet manufacturer's installation recommendations and the Carpet & Rug Institute Installation Standard 2011 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. HVAC system should be operational and running prior to carpet installation and remain running after carpet installation.

D. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to allow bond between adhesive and concrete. Concrete slabs should have moisture and pH readings that are within the specified tolerance of the adhesive to be used.

1.8 COORDINATION

A. Install entrance matting after finishing operations, including painting and ceiling work has been completed.

PART 2 - PRODUCTS

2.1 ENTRANCE / WALK-OFF MATS

A. Manufacturer: PatCraft from Shaw. 800-241-4014. www.patcraft.com

1. Product: Beyond the Door 10317 Prado

a. Construction: Eco Solution Q4 multi-level pattern loop, 100% solution dyed.
b. Tufted Pile Height: 6/32” high, 3/32” low.
c. Tufted Yarn Weight: 32 ounces.
d. Density: 8000
e. Size: 24’ x 24”

2. Colors: See Finish Schedule on Drawings for colors and patterns.

B. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification, Flooring Radiant Panel ASTM E 648: Not less than 0.45 W/sq. cm.
2. Smoke Density: Less than 450 per ASTM E662.
3. Methanamine Pill Test CPSC FF1-70: Must pass pill test.
4. Tuft Bind: Not less than 8 lbf (36 N) according to ASTM D 1335.
5. Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.
6. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
7. Dimensional Stability: 0.119 percent or less according to ISO 2551 (Aachen Test).
8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 129 ad AATCC 164.
9. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
10. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
11. Emissions: Provide carpet tile that complies with testing and product requirements of Carpet & Rug Institute's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Trowelable Adhesives: Water-resistant, mildew-resistant, nonstaining, premium grade, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation such as Shaw 5000 or Shaw 5100 or available equivalent where slab moisture does not exceed 85 percent per ASTM F 2170 or 5 lbs per ASTM F 1869. Where slab moisture does not exceed 85 percent and antimicrobial protection is needed to pass AATCC 174, use Shaw 5036. Where moisture exceeds 85 percent or 5 lbs but does not exceed 90 percent or 10 lbs, use Shaw 5900 or available equivalent.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Adhesives shall comply with the testing and product requirements of the Carpet and Rug Institute Green Label Plus Program.

C. Non-Trowelable Adhesive: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation such as LokDots where slab moisture does not exceed 95 percent per ASTM F 2170 or 10 lbs per ASTM F 1869. Each carpet tile must be adhered to the subfloor.

D. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects prior to installation. See manufacturer's requirements for substrate conditions and ambient conditions.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing moisture and pH tests as recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Lightweight concrete and gypcrete subfloors may require a primer such as Shaw 9050 or equivalent to reduce surface porosity.
5. Where previous surface treatments are unknown, or where other concerns exist as to the ability of the adhesive to bond to the substrate, a 24 hour bond test is recommended.

3.2 PREPARATION

A. General: Comply with Carpet & Rug Institute Installation Standard 2011, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds that contain a cementitious base with a latex additive, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with Carpet & Rug Institute installation Standard 2011, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive, such as LokDots**.** Any non-spreadable adhesive system must adhere the carpet to the substrate.

C. Maintain dye lot integrity. Do not mix dye lots in same area unless the specific carpet style in manufactured as a merg-able dylot product.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

I. Roll the entire installation with a 75 lb roller once installation is completed.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with Carpet & Rug Institute Installation Standard 2011, "Protecting Indoor Installations."

C. When construction or move-in activities will continue where new carpet is installed, provide non-staining building material paper to protect carpet. Do not use plastic sheeting as it can trap moisture, and self-sticking plastic sheeting can transfer adhesive residue to carpet that will attract soil.

D. When heavy objects are moved over carpet within 24 hours of installation, use plywood over carpet to prevent buckling and wrinkling.

E. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 124813

SECTION 142400 – MACHINE ROOMLESS ELEVATOR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and supplemental provisions of Contract, including General and other Division 01 Specification Sections, apply to work of this Section.

1.2 SUMMARY

A. Section includes machine roomless passenger elevators.

B. Elevator Car: Provide finished passenger elevator car including furnishing and installing the following:

1. Car wall finishes including trim.
2. Car floor finishes.
3. Car ceiling finishes.
4. Car door finishes.
5. Car door sills.
6. Car light fixtures.
7. Handrails.
8. Cutouts and other provisions for installing elevator signal equipment in cars.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station and standby power operation control panel.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
4. Indicate fire rating of the elevator door entrance citing applicable testing data.
5. Submit shop drawings to the local jurisdiction having authority for approval.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch square Samples of sheet materials; and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in Operation, and Maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Furnish well casing and coordinate delivery with related excavation work.

C. Coordinate locations and dimensions of other work relating to machine roomless elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide EcoSpace 4000 as manufactured by KONE or comparable product by one of the following:

1. Otis Elevator Company.
2. American Crescent Elevator Mfg., Corp.
3. Fujitec America, Inc.
4. Minnesota Elevator, Inc.
5. Mowrey Elevator Co.
6. Schindler Elevator Corp.
7. Schumacher Elevator Co.
8. ThyssenKrupp Elevator

C. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including motors, counterweights, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic risk Zones 3 and 4).
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch required by ASCE/SEI 7.
5. Design earthquake spectral response acceleration short period (Sds) for Project is to be completed by structural engineer licensed in the State of Washington.
6. Project's Seismic Design Category: D.
7. Elevator Component Importance Factor: 1.0.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Type: Machine Roomless.
2. Rated Load: 4000 lb.
3. Freight Loading Class for Service Elevators: Class A.
4. Rated Speed: 150 fpm.
5. Operation System: Single automatic.
6. Number of Stops: Three
7. Auxiliary Operations:

a. Standby power operation.
b. Automatic dispatching of loaded car.
c. Nuisance call cancel.
d. Independent service for service elevator.

e. Loaded-car bypass.

8. Car Enclosure: Front Opening, Right and Left Door Arrangement.

a. Car Height: 9'-0".
b. Front and Rear Walls (Return Panels): Stain stainless steel, No. 4 finish with integral car door frames.
c. Car Fixtures: Satin stainless steel, No. 4 finish.
d. Side Wall Panels: Satin stainless steel, No. 4 finish.
e. Reveals: Satin stainless steel, No. 4 finish.
f. Door Faces (Interior): Satin stainless steel, No. 4 finish.
g. Door Sills: Aluminum, mill finish.
h. Ceiling: Satin stainless steel, No. 4 finish
i. Ceiling height: 8'-4".
j. Handrails: 1-1/2 inches round satin stainless steel, No. 4 finish at sides and rear of car.
k. Floor prepared to receive resilient flooring (specified in Division 09 Section "Resilient Sheet Flooring").

9. Hoistway Entrances:

a. Width: 36 inches.
b. Height: 96 inches.
c. Type: Single-speed side opening.
d. Frames: Satin stainless steel, No. 4 finish.
e. Doors: Satin stainless steel, No. 4 finish.
f. Sills: Aluminum, mill finish.

10. Hall Fixtures: Satin stainless steel, No. 4 finish.
11. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.4 MACHINES AND COMPONENTS

A. Machine Locations: Provide elevator machinery and components designed for location as indicated on Drawings, within the space as shown.

B. Electrical Controller Unit D: Provide electro-magnetic type control equipment. Support panels on steel frames for either floor (free-standing or wall mounting) to meet NECA clearance requirements. Provide equipment designed to control starting and stopping, and to protect the motor from damage due to rest in the event of safety device operation or other possible events which might result in malfunction of elevators.

C. Equip controller unit with electrical and electronic devices needed to perform the specified operations of the elevator or group of elevators. Use flame-resistant wiring, neatly formed and tied to panels.

D. Guide Rails: Provide steel rails, supports and fasteners, complying with Code.

E. Buffers and Bumpers: Provide oil-type or spring-type buffers, or bumpers as required by and complying with Code.

F. Automatic Leveling Device: Equip each elevator with manufacturer's standard automatic leveling device, which will automatically position the stopping car within the following tolerance, regardless of travel direction, load or change in load: within 1/4" of landing floor level.

G. Locks for Hoistway and Car Doors: Provide locks, electrical contacts and interlocks on hoistway doors and car doors, as required and complying with Code. Include keyed access provisions for inspection, maintenance, emergency entrance and fire department use.

H. Sound Isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent the transmission of vibrations to the structure, and thereby, eliminate the sources of structure-borne noise resulting from the elevator system. Provide resilient care mounting (suspension) to isolate passenger cars from machine vibrations.

I. Inserts: Furnish inserts to the Contractor to be installed in accordance with the elevator shop drawings during the construction of the hoistways, pits and machine rooms for the installation of machines, rails, rail supports or bracing, hoistway entrances and other elevator components requiring inserts for anchorage or support.

J. Power Door Operators: Provide power door operator on each car door, to automatically open and close both the car door and hoistway door simultaneously, complying with Code. Provide unit with maximum door travel speed of not less than 2.5 ft. per sec., with checked speed at both limits of travel. Arrange unit button-operation from within care, operable when car is stopped or stopping at landing.

K. Manufacturer Service Tool: Manufacturer to provide software and miscellaneous hardware to connect laptop computer or service tool to hoistway equipment for maintenance and service.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

B. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Car-to-Lobby (main floor) Feature: Feature activated by keyswitch at main lobby that causes car to return immediately to lobby and open doors for inspection. On

deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 EMERGENCY RETURN

A. A battery operated emergency return device shall be provided to prevent passengers from being trapped in the elevator in the event of either a power outage or single phase condition. In such event, the elevator shall automatically return to the bottom floor and provide a door operation, after which the elevator shall be shut down with its doors closed but subject to door operation from within the car.

B. The emergency return power supply unit is to be powered by suitable batteries that are automatically maintained at full change with the charging voltage regulated.

2.8 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with non-removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
2. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.

a. Basis of Design Wall Finish: KONE satin stainless steel.

3. Fabricate car with recesses and cutouts for signal equipment.
4. Fabricate car door frame integrally with front wall of car.
5. Stainless-Steel Doors: Flush, hollow-metal construction.

a. Basis of Design Door Finish: KONE satin stainless steel.

6. Sight Guards: Provide sight guards on car doors matching door edges.
7. Sills: Extruded metal, with grooved surface, 1/4 inch thick.

8. Metal Ceiling: Flush panels, with six low-voltage LED downlights**.** Align ceiling panel joints with joints between wall panels**.**

   a. Basis of Design Ceiling Finish: KONE LF-88 satin stainless steel.

9. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

   a. Basis of Design Handrail: KONE 2 inch flat satin stainless steel.

2.9 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard 2-speed side opening horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

   1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252.

   1. Fire-Protection Rating: 1-1/2 hours with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

   1. Stainless-Steel Frames: Formed from stainless-steel sheet.
   2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both inside surfaces of hoistway door frames.
   3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
   4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.10 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

   1. Basis of Design Signalization: KONE KSS 140.

B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Swing-Return Car-Control Stations: Provide car-control stations mounted on rear of hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Mark buttons and switches for function. Use both tactile symbols and Braille.
2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

D. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

E. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.

F. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

G. Hall Push-Button Stations: Provide one hall push-button station at each landing.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.

H. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

I. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

J. Hall Position Indicators: Provide digital-display-type position indicators, located above entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.

1. Integrate ground-floor hall lanterns with hall position indicators.

K. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.

L. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

M. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.11 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

C. Stainless-Steel Bars: ASTM A 276, Type 304.

D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturer's experienced foreman.

B. Set hoistway entrances in alignment with car openings and true with plumb sill lines.

C. Install machinery, guides, controls, car and equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

D. Mount machine adjacent to hoistway on concrete slab. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.

E. Install and hook-up piping between machine and cylinder.

F. Erect hoistway sills, headers and frames prior to erection; of rough walls and doors; erect fascias and toe guards after rough walls are finished.

G. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

H. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

I. Lubricate operating parts of systems as recommended by manufacturers.

J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

K. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

L. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

M. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. Place hall lanterns either above or beside each hoistway entrance.
2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide a five year maintenance service agreement. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate**,** adjust, and maintain elevators.

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 CLEAN-UP

A. Prior to final acceptance, remove protection from finished or ornamental surfaces and clean and polish surfaces with due regard to type of material.

B. At completion of work of this Section, remove tools, equipment and surplus materials from site.

3.7 ADJUST AND BALANCE

A. Make necessary adjustments of equipment to ensure elevator operates smoothly and accurately.

END OF SECTION 142400