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END OF SECTION – 00 00 00

SECTION 011100 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

- A. CONSTRUCTION OF A NEW 11,321 SF ELDER CENTER AND FISH PIT FOR THE CONFEDERATED TRIBES OF THE CHEHALIS RESERVATION. THE NEW FACILITY WILL INCLUDE SEPARATE SPACES FOR DINING, CLASSROOM, CULTURAL ROOM, FITNESS AND MEDICAL SUITE, A LIBRARY/COMPUTER ROOM AND TWO ENTERTAINMENT ROOMS. THE CENTER IS SUPPORTED BY A COMMERCIAL KITCHEN AND STAFF OFFICES. THE BUILDING IS ANTICIPATED TO BE OF TYPE V-B CONSTRUCTION INCLUDING BOTH LIGHT WOOD FRAMING AND HEAVY TIMBER (PEELER POLE) ELEMENTS.

1.2 GENERAL INFORMATION

A. Title of Contract Documents:

1. The Chehalis Tribe Elders Center
Niederman Road, Oakville, WA 98568
Project Number: 2020006.100

B. Owner and A/E Defined:

1. Owner:

THE CHEHALIS TRIBE

CONTACT: AMY LOUDERMILK, PLANNING DIRECTOR
BRYAN SANDERS, PROJECT MANAGER
CONFEDERATED TRIBES OF THE CHEHALIS RESERVATION
PO BOX 536
OAKVILLE, WA 98568
PH: 360-709-1813
EMAIL: ALOUDERMILK@CHEHALISTRIBE.ORG

Owner's Representative: The Owner shall designate, in writing, the Owner's Representative for this Project during construction.

2. A/E: ARC Architects
Address: 119 South Main Street - Seattle, WA 98104

Representative: Paul Curtis
E-mail: curtis@arcarchitects.com
Direct: 206-900-0329
Office: 206-322-3322

3. The Owner, the A/E, and various consultants hereinafter or otherwise listed shall be given access to the Work insofar as their interests are concerned.

C. A/E's Sub-Consultants: The sub-consultants under contract with the A/E in preparation of the Contract Documents are:

- a. Structural: KPFF Engineers
 - b. Mechanical: GDM Engineers
 - c. Electrical: TFWB
 - d. Civil: KPFF Engineers
 - e. Food Service: Clevenger
 - f. LEED Consultant: O'Brien 360
 - g. Estimator: Project Delivery Analysts
 - h. Landscape: The West Studio
- D. Owner's Consultants: The consultants under contract with the Owner in preparation of the Contract Documents are:
- a. GeoTechnical Engineer
 - b. Surveyor
 - c. Commissioning Agent
 - d. Special Inspections
 - e. Traffic Engineer
 - f. A/V Engineer

1.4 PERMITS

- A. Owner will obtain and pay for the cost of the Master Use Permit (MUP) and the Building Permit.
- 1. Owner is not responsible for obtaining and paying for trade permits, including but not limited to permits for Contractor deferred design components.
- A. Contractor shall obtain and pay for trade permits such as electrical, and other trade permits, including those permits required by the Contract Documents for Contractor deferred design components.
- 1. Although the Contractor is responsible for these costs, the costs may be included with each applicable subcontract bid package.
- B. Contractor shall obtain and pay for all other permits required by Authorities Having Jurisdiction such as street use permits, utility permits, and temporary occupancy permits.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011500
CONSTRUCTION STAKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction Staking

1.02 RESPONSIBILITY

- A. Construction staking shall be the responsibility of the Contractor and shall be included in the base bid.

1.03 WORKMANSHIP

- A. Construction staking shall be done by competent craftsmen skilled in the specific Work and trade involved. Materials and equipment shall be installed in a neat and workman like manner following the best practice of the trade.
- B. All writing on stakes shall be printed legibly. Stakes shall be rewritten if text on stakes is unreadable as determined by the Owner.

1.04 QUALITY ASSURANCE

- A. Construction staking shall be performed by a surveying company under the direct supervision of a Professional Land Surveyor licensed in the State of Washington.

1.05 INSPECTION OF WORK

- A. The Contractor shall notify the Engineer once the staking has been completed to allow the Engineer to inspect the staking to see if there are any discrepancies between field conditions and the contract documents.

1.06 FIELD MEASUREMENTS

- A. The Contractor shall field verify all staking measurements, dimensions, and elevations prior to the start of Work. The Engineer shall be promptly notified of any discrepancies between the plans and the staking prior to proceeding with Work.

1.07 DAMAGED STAKES

- A. If during the course of construction the staking becomes damaged or the accuracy of the staking is in question those stakes shall be replaced at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 HUBS AND STAKES

- A. Hubs and stakes used for the purpose of construction staking shall be wood and of dimensions that are commonly used.
- B. Hubs and stakes that are split or in any way damaged shall not be used.

PART 3 EXECUTION

3.01 CONSTRUCTION STAKING

A. STRUCTURES

- 1. All structures shall have a minimum of two (2) offset stakes to properly locate the structure along the horizontal plane.
- 2. Elevations shall be specified to the nearest one hundredth (.01') of a foot.

B. SUBGRADE

- 1. Subgrade stakes shall either be set at the specific elevation location or offset as needed for proper grading.
- 2. Elevation shall be specified to the nearest one hundredth (.01') of a foot.

END OF SECTION

SECTION - 01 23 00
ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements of "Alternates."
- B. Definition: An Alternate is an amount proposed by bidders and stated on the Bid Form for certain construction activities defined in the bidding requirements that may be added to or deducted from Base Bid amount and/or a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: The Contractor shall coordinate all related Work and modify or adjust adjacent Work as necessary to ensure that the Work affected by each accepted Alternate is complete and fully integrated into the Project.
 - 1. Each Alternate bid shall include all miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- D. Notification: Immediately following receipt of a subcontract bid, Owner will notify Contractor of the status of each Alternate to indicate whether Alternates should be accepted, rejected or deferred for consideration at a later date. Contractor shall maintain a summary status log of all Alternates deferred for consideration at a later date, identifying the latest date for Owner to decide, and review at construction progress meetings.
- E. Schedule: A "Schedule of Alternates" is included in this Section. Specification sections referenced in the schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

1.2 SCHEDULE OF ALTERNATES

- 1. Solar Photo Voltaic System (Additive)
 - a. Base Bid: Solar ready per documents.
 - b. Alternate #1: Add solar panels, inverters, circuitry, and standing seam roof attachment clips to provide a fully functional solar photovoltaic system.
 - i. Solar Panels: See "Section 26 31 00 - Solar Photovoltaic System"
 - ii. Inverter: See "Section 26 31 00 - Solar Photovoltaic System"
 - iii. Circuitry: See "Section 26 31 00 - Solar Photovoltaic System"
 - iv. Attachment Clips: Unirac MetalX Standing Seam Xclamp + Seam Mount
- 2. Reductions to Landscape Scope (Deductive)
 - a. Base Bid: Full landscape plan per documents
 - b. Alternate #2a: Reductions in plant schedule, see sheet L3.10
 - i. Reductions noted as (VE ALT)
 - c. Alternate #2b: Installation of restoration planting
 - i. Deduct installation costs from restoration planting areas, owner to self-install
 - d. Alternate #2c: Deduct cistern and associated elements, see sheets L1.11, A3.1, and A8.5
 - i. Deduct items listed in value engineering notes including; cistern, cistern screen, pump and associated plumbing, electrical outlet and switch, hose spigot and associated plumbing, c-channel scupper and c-channel column support

- ii. Replace crushed gravel access path with cobble
 - iii. Replace with typical downspout tied into cistern overflow piping
- e. Alternate #2d: Deduct the below grade irrigation piping and replace with surface piping in restoration areas.
- f. Alternate #2e: Delete basket weave brick design in elder's courtyard, see sheet L1.11.
- g. Alternate #2f: Contractor to salvage all boulders from excavation and use in place of specified boulders, see sheet L1.11.
 - i. Landscape architect to locate final placements
- h. Alternate #2g: Delete raised planters from elder's courtyard, see sheet L1.11.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION – 01 23 00

SECTION 012500 – SUBSTITUTION PROCEDURES

PART I - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Work, and administrative procedures for handling requests for substitutions made before and after receipt of bid.

1.2 DEFINITIONS

- A. Definitions used in this Section are not intended to negate the meaning of other terms used in the Contract Documents.
 - 1. "Products" are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the Project or taken from previously purchased stock.
 - 2. "Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in the most recent published product literature as of the date of the Contract Documents.
 - 3. "Materials" are products that must be cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 4. "Equipment" is a product with operational parts, whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same kind, to fullest extent possible, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two 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.
- B. Nameplates: Except for labels required by Authorities Having Jurisdiction (AHJ), do not attach or imprint manufacturer's or producer's nameplates, trademarks or operating data on surfaces exposed to view in occupied spaces or on the building exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or where required by AHJ for observation after installation, on an accessible surface that is not conspicuous.

1.4 PRODUCT SELECTION

- A. General Product Requirements: Unless otherwise indicated, provide products that comply with the Contract Documents and that are undamaged and unused at the time of installation.

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and with details needed for a complete installation for the intended use and effect.
 2. Where available, provide standard products of a type and manufacturer used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations. Procedures governing product selection include the following:
1. Performance Specifications: Performance specifications may be one of the following:
 - a. One or more named reference(s) with no accompanying conditioning language such as "or approved equal" or "no substitutions"; or
 - b. No named reference is specified, and requirements are specified by means of any of the following:
 - (1) Descriptive requirements
 - (2) Design requirements
 - (3) Performance requirements
 - (4) Regulatory requirements and/or industry standards

References to equipment, material, articles or patented processes by trade name, manufacturer, make or catalog number, are presumed to set a standard of quality so as to encourage competition. The term "equal" is presumed and need not be repeated in the Specifications. Where Specifications set a standard of quality, provide product options complying with or exceeding the provisions of the Contract Documents, and which are recommended by a manufacturer for the applications indicated. No Substitution Request is required. However, Owner may request, and Contractor shall provide, documentation of the manufacturer's recommendations for a particular product application.

1. Closed Proprietary Specifications: Products by one or more manufacturers are specified, and the specification section includes the term "no substitution(s)," "no other(s)," or "no exceptions." No other product options will be accepted. Provide products and work as specified.
2. Open Proprietary Specifications: Products by one or more manufacturers are specified, and the specification section includes the term "or approved equal," or "other acceptable." Submit the Substitution Request Form for other products to Owner under the provisions of this Section.
4. Visual Matching: Where matching an established sample is required, the Owner's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where there is no product available within the specified product category which matches satisfactorily and also complies with other specified requirements, the contractor shall comply with the provisions of the Contract Documents concerning substitutions for the selection of a matching product in another product category.
5. Visual Selection: Where specified product requirements include the phrase "...as selected from the manufacturer's standard colors, patterns, textures..." or similar phrases, select a product and manufacturer that complies with other specified

requirements. Owner will select the color, patterns and texture from the product line selected.

1.5 PRODUCT SUBSTITUTION

A. General:

1. No substitution request will be considered unless submitted in accordance with the requirements of this Section.
2. If a bidder or Contractor desires approval of some material or product other than that specified by the Contract Documents, it must submit a written request for approval of the proposed substitute item to the Owner in accordance with the following requirements:
 - a. All requests must be made on the Owner's Substitution Request Form
 - b. After receipt of bid, substitution requests shall be prepared, transmitted, and processed in accordance with Section 01 33 00 "Submittal Procedures."
3. Final decision as to whether an item is an equal or acceptable substitution rests solely with the Owner.

B. Substitution Requests: Every substitution request must state whether the item offered is equal or superior to the specified product. The substitute material or product must be accompanied by its reference in the Contract Documents and complete catalog, technical and other information. If applicable, include samples showing comparison of physical and other pertinent characteristics as required to establish equivalence of acceptability for the proposed application. Where specific test results are required by the Contract Documents, the comparison data for the proposed item shall be based upon the same test methods as those specified, or they shall be correlated to clearly demonstrate comparability. The same warranty of the Work described for the specified product is required for the substitution.

C. During Bid Period:

1. Submit Substitution Request Form prior to the date identified in the "Instructions to Bidders."
2. Bidders will be notified by addendum of products accepted in addition to those specified. NO OTHER FORM OF APPROVAL, INCLUDING VERBAL OR IMPLIED, IS ACCEPTABLE AS AN INDICATOR OF ACCEPTED SUBSTITUTION REQUESTS.

C. After Receipt of Bid: Contractor shall indicate one or more reasons why a product substitution is required with a Substitution Request Form. Owner will notify Contractor in writing of decision to accept or reject the Substitution Request. Substitution Requests will not be considered except for the following reasons, which must be substantiated by the Contractor:

1. Unavailability: Specified item has been discontinued or is unavailable in time to meet Construction Schedule through no fault of the Contractor or Subcontractor.
2. Unsuitability: Subsequent information discloses the specified item as unsuitable, inappropriate, or unable to perform properly or fit the designated space.

3. Regulatory Requirements: A substitution is required to comply with code interpretations by AHJ or insurance regulations.
 4. Warranty: A manufacturer or fabricator declares the specified item to be unsuitable for the use intended or refuses to certify or warrant the performance of the specified item for the Project.
 5. Owner's Benefit: In the judgment of Contractor, acceptance of the proposed substitution is clearly in Owner's best interest because of cost, quality, or other consideration.
- D. Coordination: In making a Substitution Request, the Contractor certifies that it will coordinate all Subcontractor work required by the substitution and waives all claims for additional costs and/or time which subsequently become apparent as a consequence of the substitution.
- E. Re-design: At the Owner's sole discretion, the Contractor shall bear all Owner costs related to the substitution, including costs of A/E's services for investigation, evaluation and re-design, if necessary.
- F. Owner will not consider:
1. Substitutions, if they are indicated or implied on Shop Drawings or other Project data submittals;
 2. Substitutions which, if accepted, will require substantial revisions of Contract Documents; or
 3. Substitution Request Forms which do not provide adequate or clearly defined information for complete and timely appraisal.

PART 2- PRODUCTS (Not Used)

PART 3- EXECUTION (Not Used)

END OF SECTION

SECTION 012600 – CONTRACT MODIFICATION PROCEDURE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the administrative and procedural requirements for executing a change in the Work as herein specified and further described in the General Conditions.

1.2 PRELIMINARY REQUIREMENTS:

- A. Prior to submitting Contractor's first Change Order Request (COR), or responding to the first Change Order Proposal (COP), the Contractor shall submit a breakdown of journeyman and apprentice wage rates using the Owner's COP Wage Rates form. The breakdown shall show:
1. Basic wage rate (based on L&I Intent to Pay Prevailing Wages or union agreement);
 2. Fringe Package (based on L&I Intent to Pay Prevailing Wages or union agreement);
 3. FUI (Federal Unemployment Insurance);
 4. FICA (Federal Insurance Compensation Act);
 5. Medicare;
 6. SUI (State Unemployment Compensation Act);
 7. WC (Workers Compensation).
- B. Contractor shall submit verification of the above rates, if requested by Owner's Representative.
- C. Prior to submitting Contractor's first COR or responding to Owner's first COP that involves equipment owned by the Contractor, the Contractor shall submit a list of all equipment anticipated to be used on the Project. Contractor shall provide the hourly rate based on the Equipment Watch Rental Rate Blue Book and as modified by other sources as referenced in the General Conditions. The Contractor shall use the Owner's COP Equipment Rates form to compute the equipment rate.

1.3 CHANGE ORDER PROCEDURES

- A. Owner Change Order Proposal (COP): Changes may be initiated by Owner through a Change Order Proposal form submitted to the Contractor. Such a request is for information and pricing only and is not an instruction to execute changes or to stop work in progress, unless issued as a Field Order.
1. The COP will include:
 - a. A detailed description of changes, products, and location of modification in Project and a statement as to whether overtime work is authorized; and,
 - b. Supplementary or revised Drawings or Specifications.
 2. An updated Construction Progress Schedule may be requested if the COP impacts the existing Construction Progress Schedule.

- B. Contractor Change Order Request (COR): The Contractor shall initiate changes by submitting written correspondence, in letter format, signed and dated to the Owner's Representative requesting a Change Order Proposal. The letter shall include:
1. Description of proposed changes;
 2. Reason for making changes;
 3. A specific period of time during which requested price will be considered valid;
 4. Actions required by Owner;
 5. Effect on Total Contract Cost and Contract Time;
 6. Documentation consistent with the requirements of Part 7.02 and/or 7.03 of the General Conditions supporting any change in Total Contract Cost or Contract Time, as appropriate;
 7. Statement of why proposed change is not covered in Contract Documents; and
 8. Date the Work is to be completed.
- C. Field Order: In situations where time is of the essence or an emergency condition exists, the Owner's Representative may directly order a change to the Work by a written Field Order signed by Owner's Representative. Field Orders will only be issued on an agreed upon maximum not-to-exceed cost basis, either lump sum or time and materials.
- D. Team Change Memorandum: A Team Change Memorandum shall be submitted for any changes that will make use of the Contractor's Risk Contingency Account as allowed for in the General Conditions. The Contractor shall request the Owner's concurrence before executing such changes by submitting a Team Change Memorandum with the scope of the changed work clearly delineated. The Owner will note, by return endorsement, concurrence with the technical solution and whether or not funds for the change can be drawn from the Contractor's Risk Contingency Account.
- E. Change Order Pricing:
1. The cost of the change shall be marked-up in accordance with General Conditions. NO ADDITIONAL MARK-UPS SHALL BE ALLOWED.
 2. Contractor shall provide all backup pricing documentation for a change on the following forms (THESE FORMS SHALL ALSO BE THE ONLY ACCEPTABLE DOCUMENTATION FOR ALL SUBCONTRACTORS.):
 - a. COP GC Breakdown Summary
 - b. COP Subcontractor Breakdown Summary
 - c. COP GC as Subcontractor Breakdown Summary;
 - d. COP Cost Breakdown
 3. Owner's Representative may require Contractor to provide certified payroll.
 4. Provide all other supporting documentation as required to substantiate the requested

costs such as invoices for rental equipment and freight cost. Total cost and time shall be brought forward to the COP form and signed and dated by Contractor.

F. Change Order Authorization:

1. A/E recommendation of COP acceptance is indicated by A/E's signature.
2. Upon signature and execution by Owner, the Change Order Proposal becomes a Change Order altering the Total Contract Cost and/or Contract Time, as indicated.
3. Contractor may only request payment for changes in the Work against an approved Change Order.
4. If Owner disapproves the Change Order Proposal, the reason for disapproval will be stated. A request for a revised proposal or cancellation of the proposal will be shown and returned to Contractor.

G. Correlation with Contractor's Submittals:

1. Application of Payment forms shall record each Change Order as a separate item of work (see Section 01 29 76 "Progress Payment Procedures").
2. Revise Construction Progress Schedule to reflect changes in Contract Time.
3. Upon completion of Change Order work, record pertinent modifications in the Project Record documents.

H. Distribution:

1. Upon authorization of a Change Order, Owner will transmit one (1) signed copy to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00 - PAYMENT PROCEDURES

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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 01 32 16 "Construction Progress Schedule" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
 - a. List of sub-scheduled work:
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Owner's name.
 - c. Owner's Project number.

- d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 25th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment two days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703, or adopted contractor forms of similar format as allowed by Architect, as form for Applications for Payment.
 1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit electronic signed and notarized copy of each Application for Payment to Architect. Copy shall include waivers of lien and similar attachments if required.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values (item must precede first application of payment).
 3. Contractor's construction schedule (preliminary if not final).

4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
- J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 013001 – SUBMITTAL NUMBERING FORMAT

PART 1 - GENERAL

1.1 SUMMARY

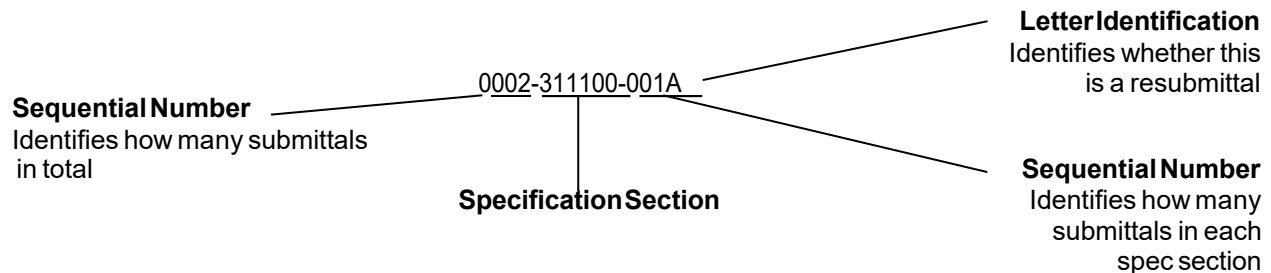
A. Related Sections

1. Section 01 78 23 – Operations and Maintenance Data.

1.2 SUBMITTAL FORMAT

A. Submittals should be numbered by the Contractor prior to sending them to the Architect for review.

1. Numbering should be as follows:



B. Examples:

1. Submittal # 0002-311100-001A is the 2nd submittal overall; it is in spec section 311100; it is the 1st submittal so far in that spec section; and "A" indicates that it is the first time it has been submitted.
2. If a submittal is returned as "Revise and Resubmit", a resubmitted number would look like this: # 0007-311100-001B. That means it is the 7th submittal overall; it is in spec section 311100; it is the resubmittal of the 1st submittal under that section. It is much easier to find the original rejected submittal, if its resubmittal carries the same sequential number under the spec section (01) as it did originally.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project management and coordination during construction, in addition to the requirements specified elsewhere in the Contract Documents.

1.2 GENERAL COMMUNICATION

- A. The Owner shall designate, in writing, the Owner's Representative for this Project.
- B. All verbal communications between Owner, A/E, and Contractor shall be for clarification and collaboration purposes and are not binding unless issued in writing through the Owner's Representative.
- C. Contractor communications by and with A/E's consultants shall be through the A/E, and A/E's communications by and with the Contractor's Subcontractors shall be through the Contractor.
- B. In case of an emergency:
 - 1. Contact the Owner's Representative; and
 - 2. Follow emergency procedures in accordance with Section 01 35 23 "Owner Safety Requirements."

1.3 CORRESPONDENCE

- A. Address all correspondence to Owner's Representative.
- B. All correspondence to and from Contractor will be routed through the Owner's Representative.

1.4 CONTRACTOR REQUEST FOR INFORMATION

- A. When field conditions or Contract Documents require clarification or verification by the A/E or A/E's consultants, a written RFI is to be submitted per the following:
 - 1. Identify the nature and location of each requested clarification and/or verification using the RFI form. Provide as a minimum the following information:
 - a. Project name and number
 - b. Date
 - c. Date response required by
 - d. RFI number
 - e. Subject
 - f. Initiator of the question
 - g. Indication of costs, if known
 - h. Location on site
 - i. Contract Drawing reference
 - j. Contract Specification section and paragraph reference
 - k. Descriptive text

2. Number each RFI sequentially beginning with #001. Submit only one question per RFI. Also, RFI's shall be categorized as ARCH, MECH, ELEC, etc.

1.5 CLARIFICATIONS

- A. Clarifications may be discussed with A/E, or A/E's consultants, with concurrence of Owner. Following the discussion, the Contractor shall document on an RFI form any agreed upon modification which does not require a Change Order. The A/E may provide supplemental information to clarify the Contract Documents. RFIs and A/E supplemental information (ASI) which modify or change the Work will be authorized only by Change Order.

1.6 NON-CONFORMANCE REPORT

- A. Non-Conforming Work: Work found defective, or in any way not in accordance with the requirements of the Contract Documents, is defined as non-conforming Work.
- B. Procedure: If, after an oral discussion or written notification, the Contractor fails to correct Work that is found defective or not in accordance with the Contract Documents, the Owner will issue a Non-Conformance Report (NCR). Upon receipt of an NCR, the Contractor shall take immediate action to resolve the Work to the Owner's satisfaction, or remove and replace with conforming Work at Contractor's expense and with no increase in Contract Time. Corrective actions for non-conforming Work shall be discussed at construction progress meetings and be completed no later than prior to Final Completion.
 1. Where non-conforming Work requires re-design by the A/E, such re-design costs shall be borne by the Contractor.

1.7 COORDINATION

- A. General Coordination:
 1. The Contractor shall be in charge of this Contract and the Project, as well as directing and scheduling of all Work. Final responsibility for performance, interface, and completion of the Project shall be the Contractor's.
 - a. Anticipate interrelationship of all Subcontractors and their relationship with the total Work.
 - b. Resolve differences or disputes between Subcontractors and materials suppliers concerning coordination, interference, or extent of the Work. Contractor's decisions, if consistent with Contract Document requirements, shall be final.
 2. Cooperation with building occupants may be required when scheduling construction activities that create excessive noise or structure-borne vibration. The Contractor is to cooperate with the Owner in coordination of all work to minimize these impacts to the Owner's operations (see Section 01 50 00 "Temporary Facilities and Controls").
- B. Special Coordination:
 1. The Contractor is responsible for receiving, unloading, storage and handling of Owner Furnished Contractor Installed (OFCI) items from the time of receipt through Substantial Completion.

- a. The Contractor is responsible for protecting OFCI and Owner Existing Contractor Installed (OECI) items from damage, such as: damage from exposure to the elements; or from damage to a warranty due to Contractor's improper installation and testing. The costs to repair or replace items damaged while in the Contractor's possession shall be borne by the Contractor.
 - (1) The Contractor shall consult with the Owner to determine the warranty requirements of OFCI and OECI items.
2. Main Distribution Frame (MDF) and Intermediate Distribution Frame (IDF) rooms early construction completion: Two weeks minimum prior to the date required for the first inspection and testing of elevator, fire alarm systems, or other systems required by AHJ for Substantial Completion, or for Owner's Prior Occupancy, the Contractor shall complete the Work of new MDF and IDF rooms, as required for early building services activation. The Work includes, but is not limited to, the following:
 - a. Install all finishes and products specified for the MDF and IDF rooms and provide complete mechanical and electrical services for the rooms.
 - b. Install doors and locks and provide three (3) sets of keys to the Owner.
 - c. All necessary Contractor Furnished Contractor Installed (CFCI) conduit pathways between the MDF and IDF rooms shall be installed and CFCI room cable required for the early service outlet locations shall be terminated and tested and the test results provided to the Owner.
 - d. The entire room and all components shall be entirely HEPA vacuumed. NO DUSTING OR SWEEPING IS ALLOWED. The rooms must be dust-free and maintained by Contractor dust-free until Substantial Completion.
- C. Mechanical, Electrical and Pool Contractor Coordination:
 1. Resolve all tight or restricted conditions involving work of various sections in advance of installation.
 2. Coordinate the Work of all sections to ensure that all fixtures, devices, switches, outlets, ducts, pipes, and similar items can be installed as shown.
- D. Job Site Field Measurements and Templates:
 1. Obtain field measurements required for accurate fabrication and installation of work included in the Contract Documents. Exact measurements are the Contractor's responsibility.
 2. Furnish or obtain templates, patterns, and setting instructions as required for installation of all work. Verify in field.

PART 2- PRODUCTS (Not Used)

PART 3- EXECUTION (Not Used)

END OF SECTION

SECTION 013119 – PROJECT MEETINGS

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for meetings during construction in addition to requirements specified elsewhere in the Contract Documents.
- B. Contractor and Subcontractor representatives attending meetings must be qualified and authorized to act on behalf of their firms.
 - 1. Meeting minutes, Contractor construction activity data and work plans, A/E field reports and other such communications shall be distributed electronically by e-mail.
- C. Related Sections:
 - 1. Section 01 32 16 “Construction Progress Schedule”

1.2 PRECONSTRUCTION MEETING

- A. The Owner will schedule a preconstruction meeting to be held prior to the Contractor mobilizing and beginning any Work. This meeting will review Contract administration requirements and mobilization procedures.
- B. Meeting location: To be determined
- C. Participants shall include:
 - 1. Contractor's Project Manager, Superintendent, and other key personnel as appropriate;
 - 2. Owner's Representative;
 - 3. A/E and the A/E's sub-consultants, as appropriate;
 - 4. Owner's consultants, as appropriate; and
 - 5. Others, including the Contractor's major Subcontractors as appropriate.
- D. GC will: Administer the meeting
- E. GC will: Record and distribute copies of the minutes within seven (7) days of the meeting to all meeting participants.
- F. Agenda:
 - 1. The Work including, but not limited to:
 - a. Schedule and phasing requirements
 - b. Contractor's use of premises
 - c. Special conditions and coordination
 - 2. Communications including, but not limited to:
 - a. Chain and persons authorized to direct changes
 - b. Requests for Information (RFI), field decisions, and clarifications
 - c. Non-Conformance Reports

- d. Hazard communication
 - e. Project meetings
- 3. Contractor's "Site Specific Safety Plan"
- 4. Administrative and procedural requirements including, but not limited to:
 - a. Contract modification
 - b. Progress payment
 - c. Submittals - including Contractor's Progress Schedule
 - d. Electronic communications
- 5. Testing and inspection
- 6. Contractor quality control
- 7. Temporary facilities and controls including, but not limited to:
 - a. Deliveries and storage
 - b. Temporary utilities and enclosures
 - c. Security procedures
 - d. Noise and vibration control
 - e. Cutting, patching, and field engineering
 - f. Utility shutdowns
 - g. Contractor parking
 - h. Housekeeping and waste management
 - i. Infection control - for medical facilities projects
- 8. Closeout procedures – including Project Record requirements
- 9. Other information as appropriate
- G. Contractor shall conduct a like meeting, covering the same body of information, with each Subcontractor's project manager and foreman supervising the Work prior to the performance of any work on-site by that Subcontractor.
 - 1. Provide Owner copies of meeting minutes prepared by the Contractor with each Subcontractor, when requested by Owner.

1.3 CONSTRUCTION PROGRESS MEETINGS

- A. Progress meetings shall occur weekly until Substantial Completion has been achieved.
- B. Meeting location: Contractor's Job Site Trailer, or as mutually agreed
- C. Participants shall include:
 - 1. Contractor's Project Manager, Superintendent, and other key personnel as appropriate;
 - 2. Owner's Representative;
 - 3. A/E and the A/E's sub-consultants, as appropriate; and
 - 4. Others, including the Owner's consultants, as appropriate.
- D. Contractor shall:
 - 1. Administer the meeting;

2. Provide schedules, logs and other construction activity data in support of the issues discussed at and recorded in the meeting minutes; and
3. Record and distribute copies of the minutes prior to the next progress meeting to all meeting participants and provide copies at each meeting.

E. Agenda:

1. Review and approve the minutes of the previous meeting noting exceptions, if any
2. Review the progress of the Work since the previous meeting
3. Review the Short Interval Schedule and work plans for progress during the period
 - a. Identify pending meetings
 - b. Discuss safety activities and job hazards analysis
4. Discuss field observations, problems, and conflicts
 - a. Identify problems impeding the construction Progress Schedule
5. Review Quality Control
 - a. Non-Conformance Reports - discuss corrective Work actions
 - b. Infection control - for medical center projects
6. Review the Submittal Schedule and RFIs - present methods to expedite as required
7. Review off-site fabrication and delivery schedules
8. Review proposed changes in the Work and substitution requests for:
 - a. Timely processing
 - b. Effect on the Progress Schedule and Substantial Completion
 - c. Effect on any other contracts of the Project
9. Review the Schedule of Alternates status log, if any
10. On a monthly basis, review progress on inclusion of diverse businesses
11. Review any other business.

1.4 PRE-INSTALLATION MEETINGS

- A. Pre-installation meetings shall be held prior to the Contractor or Subcontractors beginning work on each definable feature of the Work identified in the Contract Documents to require a pre-installation meeting and/or as required by the Owner's Representative. Notify Owner's Representative at least ten (10) working days in advance of each pre-installation meeting. Meeting examples include, but not by way of limitation:
1. Site clearing and excavation
 2. Demolition and regulated materials remediation
 3. Site utilities
 4. Landscaping and site restoration
 5. Concrete
 6. Masonry
 7. Structural steel
 8. Exterior cladding systems
 9. Water and damp proofing and roofing
 10. Doors, including frames and hardware
 11. Millwork

12. Finishes
 13. Equipment, including elevators
 14. Mechanical and Electrical systems, such as high voltage, fire alarm, and communications
 15. Specialty items
- B. Meeting location: Contractor's Job Site Trailer, or as mutually agreed
- C. Participants shall include:
1. Contractor's Superintendent, Project Manager and other key personnel as appropriate;
 2. Subcontractor's project manager or foreman supervising the Work, as appropriate;
 3. Owner's Representative;
 4. A/E and the A/E's sub-consultants, as appropriate;
 5. Owner's consultants as appropriate; and
 6. Others as appropriate.
- D. Agenda:
1. Review of the pre-installation CQC Work Plan and Contract requirements
 2. Materials - available and ready for use
 3. Submittals
 4. Persons responsible for performing the work
 5. Tests - required tests, criteria for performance, who samples and how often
 6. Safety procedures and requirements
 7. Substrate - criteria for substrate
 9. Other items as appropriate
- E. Contractor shall: Administer the meeting, and record and distribute copies of the minutes within seven (7) days of each meeting to all meeting participants.

1.5 CHANGE ORDER MEETINGS

- A. Change order meetings shall be held to review and resolve any change order proposals, change order requests, or other change order issues pertaining to Contract Modification. Meetings shall be held monthly until all Change Order Proposals are resolved.
- B. Meeting location: Contractor's Job Site Trailer, or as mutually agreed
- C. Participants shall include:
1. Contractor's Project Manager, or cost engineer as appropriate;
 2. Owner's Representative;
 3. A/E and the A/E's sub-consultants, as appropriate; and
 4. Others, including the Owner's consultants as appropriate.
- D. GC will: Administer the meeting
- E. Agenda: Review Change Order Proposals for scope and estimated costs, and negotiate Change Order Proposal prices.

1.6 DRAFT APPLICATION FOR PAYMENT REVIEW MEETINGS

- A. Draft Application for Payment review meetings shall occur monthly.

- B. Meeting location: Contractor's Job Site Trailer, or as mutually agreed
- C. Participants shall include:
 - 1. Contractor's Project Manager;
 - 2. Owner's Representative;
 - 3. A/E and A/E's sub-consultants, as appropriate; and
 - 4. Owner's consultants as appropriate.
- D. GC will: Administer the meeting.
- E. Contractor shall: Present the draft monthly Application for Payment together with required back up information for review and comment by the Owner and A/E.
- G. Agenda - Discussion will pertain to items such as:
 - 1. Percent of work complete
 - 2. Off-site storage
 - 3. Bill of quantities
 - 4. Percentage of subcontract payment allocations
 - 5. Apprentice Utilization and Journey Level Report

1.8 COMMISSIONING MEETINGS DURING CONSTRUCTION

- A. Regular, on-site commissioning meetings shall occur weekly during the start-up and commissioning phase of the Work.
- B. Meeting location: To be determined.
- C. Commissioning Authority will: Administer the meetings.
- D. Refer to Section 01 91 00 – "General Commissioning Requirements" for additional meetings that the Contractor shall participate in as well as the typical agenda for those meetings.

1.9 SPECIAL MEETINGS

- D. Special meetings may be called at the discretion of the Owner or Contractor for the purpose of coordinating specific information or resolving special issues related to the Project.
- B. Contractor shall record and distribute copies of the minutes within three (3) days of the meeting to all meeting participants.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements, in addition to those defined in the General Conditions for schedule software, Baseline Progress Schedule preparation, monthly Progress Schedule updates, contemporaneous period schedule analysis, submittal schedules, and short interval schedules.
- B. Related Sections:
 - 1. 01 26 00, "Contract Modification Procedures"
 - 2. 01 29 76, "Progress Payment Procedures"
 - 3. 01 50 00, "Temporary Facilities and Controls"
 - 4. 01 77 00, "Closeout Procedures"
- D. As used in this Section, "Progress Schedule" refers collectively to "Baseline Progress Schedule" and "monthly Progress Schedule updates".

1.2 SCHEDULE SOFTWARE

- A. The Contractor shall propose a computer scheduling software for Owner approval. The selected software must be capable of performing baseline-to-current schedule comparisons, cost and resource loading functions. Activities must be able to process lead and lag time relationships, start-to-start or finish-to-finish relationships, and be capable of being "hammocked" as required.
- B. Total Float is defined as the amount of time between the earliest start date and the latest start date, or between the earliest finish date and the latest finish date of an activity on the Progress Schedule. Float is not for the exclusive use of either the Contractor or the Owner unless otherwise identified in the Contract Documents.
 - 1. Extensions of time for Contract performance will be granted only to the extent that equitable time adjustments to the affected activity or activities exceed the total float time along the affected paths of the current Progress Schedule at the time a Field Order, or Change Order, was issued for the change.
- C. All Progress Schedule submittals, including monthly Progress Schedule updates, will be reviewed jointly by the Owner's Representative and the Contractor. Such review of the Contractor's schedules 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.

1.3 PROGRESS SCHEDULE

- A. Within sixty (30) calendar days after GC Contract execution, the Contractor shall prepare and submit to the Owner, for review and comment, a preliminary Progress Schedule utilizing a Critical Path Method (CPM) logic, based on the Contract Documents. The Owner will review the preliminary schedule for conformance with the Contract Documents and provide comments within fourteen (14) calendar days of receipt from the Contractor. The Contractor shall respond to all comments and provide the Owner a Baseline Progress Schedule within fourteen (14) calendar days of receipt of the Owner's comments.

- B. Once the Baseline Progress Schedule is submitted to the Owner, the Progress Schedule shall be formally established as the baseline file within the Contractor's scheduling software. This baseline file shall not be modified without the Owner's written approval.
1. The amount specified in Section 01 29 76 shall be withheld from the Contractor's monthly Application for Payment if the Baseline Progress Schedule is past due.
- C. The Baseline Progress Schedule shall be the basis that the Contractor shall use: plan, organize, and execute the Work; record and report actual performance and progress through updates, and; show how the Contractor plans to complete all remaining Work. The Baseline Progress Schedule and monthly Progress Schedule updates shall be the basis for consideration and analysis of requests for time extensions as specified below. The schedule shall be in the form of an activity oriented precedence network diagram.
- D. The Baseline Progress Schedule and monthly Progress Schedule updates shall be constructed to show the order in which the Contractor proposes to carry out the Work and to indicate the restrictions of access to and availability of work area, and availability and use of manpower, materials, equipment, and include all activities of trade contractors, equipment vendors, suppliers, and Negotiated Support Services expenses. The Progress Schedule shall incorporate contractually specified limitations and restrictions, and contractually specified milestones. Construction activities shall match or be correlated with the pay items in the approved Schedule of Values. The Progress Schedule shall be prepared in sufficient detail with the assignment and coding of all activities by the Contractor and Subcontractors in consideration of, but not limited to, the following Work activities:
1. Access and availability to the Project Site, including road closures;
 2. Interfaces and dependencies with preceding, concurrent, and succeeding contractors, if applicable;
 3. The type of work to be performed and labor trades involved;
 4. All procurement, manufacturing, fabrication (both on-site and off-site), and delivery activities for all major materials and equipment;
 5. Shutdowns of existing Owner's equipment and utility services;
 6. Required delivery dates of OFCI equipment and materials;
 7. Testing, air balancing, and commissioning activities, including submission and approval of test results and final commissioning report;
 8. Approvals required by regulatory agencies or other third parties, including obtaining an Occupancy Permit;
 9. Coordination for Owner's occupancy including Owner's cleaning, OFOI equipment and furnishings installations;
 10. Planning for phased occupancy by the Owner, with intermediate completion dates;
 11. Contractor's preliminary cleaning and final cleaning operations;
 12. Contractor's Final Punch List Report, Owner's Final Inspection (Punch List), Contractor's corrections, and Owner's re-inspection;
 13. Substantial Completion and Final Completion activities and milestones, and Final Acceptance.
- E. The activities defined in the Progress Schedule shall represent the planned durations in anticipation of normal man-power and equipment utilization in durations of whole working days. No activity durations shall exceed twenty two (22) working days. If approved by the Owner, longer durations may be allowed for non-construction activities such as procurement, delivery, or submittal activities. All durations shall be determined based upon resource planning under contractually defined on-site work conditions. In calculating activity durations, normal inclement weather shall be considered. The Contractor shall schedule the Work to minimize the effect of adverse weather. The Contractor shall also protect the work site from

the effects of adverse weather or take other necessary measures such that the Work can be completed within the time established in the Contract Documents and include these provisions in the schedule as appropriate.

F. Schedule activity identification codes shall not be alphanumeric unless approved by Owner.

1. Activity Description: Provide adequate information to readily identify each activity up to 48 characters in the general descriptive format: action, item, location (such as Install Steel Studs 3rd Floor).
2. Activity Codes: The Contractor shall develop and provide a complete, efficient and understandable Work Breakdown Structure (WBS) code to submit to the Owner for review and approval. In addition to the WBS, activity codes may be created and assigned a conventional WBS scheme, activity codes shall be used in lieu of the WBS. Suggested character fields for the code structure are:

Name	Length	Description
PHAS	1	Phase or stage
TYPE	4	Type of activity
FLOR	1	Floor
AREA	4	Area and/or room
RESP	7	Responsible party
SPEC	5	CSI section number
OF/CI	4	Owner Furnished/Contractor Installed Equipment

3. The Critical Path shall be clearly indicated on all diagrams submitted. An activity is critical when it is part of the longest duration pathway(s) through the CPM network or when its total float is less than or equal to zero.
4. At the Owner's request, furnish a written narrative of the Contractor's determination of durations for particular activities. Such explanation may include the number of crews, crew composition, number of shifts per day, number of hours in a shift, and number of work days per week, construction equipment, material quantities, productivity qualifiers (such as weather), etc.
5. At the Owner's request, a written explanation shall be provided for leads and/or lags on relationships and for constrained dates. These scheduling constraints shall be disallowed unless a compelling reason exists for their use.
6. Clearly identify activities which are planned to use of overtime, double shifts, work on weekends or holidays.
7. Schedule Statistics Report: Each submittal involving graphical and/or tabular reports using CPM shall be accompanied by a Schedule Statistics Report. Include a listing of activities with open ends and out-of-sequence progress, constraints, the schedule calculation modes (retained; contiguous or interruptible) and other statistics that are normally a part of this report.

J. The Contractor shall submit the Progress Schedule as specified by this Section monthly, in the following quantities.

1. One copy in the approved computer scheduling software's native format, displaying all

activities in a time scaled format with their logical relationships.

2. One copy in a pdf printed format.
- K. Qualifications: The Contractor shall submit the resume(s) of the designated person(s) responsible for schedules and reports (the "Contractor's Scheduler"). The "Contractor's Scheduler" shall have demonstrable capability to plan, coordinate, execute, and monitor a CPM schedule as required for this Project. Submit the qualifications of the "Contractor's Scheduler" no later than five (5) days after the GC Contract execution. The Owner's Representative will approve or reasonably disapprove the proposed "Contractor's Scheduler". In the event of disapproval; a new scheduler shall be proposed within one (1) week and be subject to the same consideration criteria as noted above.
- L. Certification: When requested by the Owner, submit certification that each Subcontractor and major equipment supplier has participated in, reviewed, and concurs with the Progress Schedule and the associated cost data as it relates to their Work.

1.4 MONTHLY PROGRESS SCHEDULE UPDATES

- A. The Contractor is required to prepare and submit monthly Progress Schedule updates and to participate in monthly schedule update meetings with the Owner as described below.
 1. Timely submission of updates is of significant and crucial importance to the management of the Project. Lack of, or late receipt of, updates diminishes their value to the Owner. If a monthly Progress Schedule update is not submitted to and reviewed with the Owner prior to the Contractor submitting its monthly Application for Payment; the monthly Schedule of Values amount for Progress Schedule updates may, at the Owner's sole judgment and discretion, be reduced from the Specified General Conditions by a unilateral Change Order (see Section 01 29 76, "Progress Payment Procedures").
- B. The Contractor shall prepare monthly Progress Schedule updates to reflect work progress achieved since the previous update. Historical performance data and/or records shall not be changed without approval of the Owner.
- C. The Contractor shall, in a second and subsequent report, incorporate any logic and duration changes that represent its revised planning, provided all such changes are identified and submitted to the Owner for comment in the narrative report required herein this Section.
- D. The Contractor shall use and maintain a fixed end date when generating the required reports and diagrams for the Owner as specified by this Section. The fixed end date shall be the Substantial Completion date. The fixed end date will be adjusted in subsequent updates only to reflect approved time extensions incorporated by Change Order.
- E. The Project shall be rescheduled each reporting period with:
 1. An updated data.
 2. Actual start/finish dates.
 3. Percent complete.
 4. Remaining durations (for each activity in the "status" or "current file).
- F. Show changes occurring since the previous schedule submission, such as:

1. Any major changes in scope.
 2. Activities modified since previous submission including, but not limited to, logic changes.
 3. Revised projections for progress and completion, as applicable.
 4. Any other identifiable changes.
- G. The Contractor shall account for all rain days, for major events, and similar excusable non-compensable delays, during which little or no work is progressed and that are acknowledged by the Owner, in the period within which the events occur. The Contractor may account for such delays within the Contemporaneous Period Schedule Analysis and the Progress Schedule update by treating the events as it would a typical holiday at the calendar function of the software. By whatever method the Contractor chooses to account for such delays and events, a narrative description of the accounting shall be included with the narrative report required herein this Section.
- H. The Construction Progress Meeting shall be held prior to the Owner's review and comment of the Contractor's monthly draft Application for Payment, unless otherwise approved by Owner.

1.5 CONTEMPORANEOUS PERIOD SCHEDULE ANALYSIS

- A. It is the Owner's desire and intent to resolve all issues affecting the Substantial Completion date in a timely, efficient, and effective manner. To achieve this goal, the Owner and Contractor shall participate in contemporaneous analyses of all delays and advances of the schedule by application of the Contemporaneous Period Schedule Analysis method. The Contemporaneous Period Schedule Analysis shall coincide with the monthly schedule update meetings.
- B. Assessment of impacts due to changes or other events, in accordance with the Contemporaneous Period Schedule Analysis method described herein, must be performed on the most recent update of the Progress Schedule. Further, impacts due to changes or other events shall be assessed utilizing the Progress Schedule update that represents the data date closest to, and just prior to, the date of the impacting event. An alternative method can be to progress the schedule to a data date that represents the date of the impacting event. Subsequent to the assessment of schedule sequences representing the impacting events, the schedule may be updated to the next data date with appropriate logic or duration changes resulting from the impacting events. All data shall be provided to the Owner.
- C. The logic and planning elements of the Progress Schedule are the Contractor's responsibility.
1. No Contract Time shall be modified unless directed by an approved Change Order.
- D. Submission of a valid monthly Progress Schedule update and the completion of the Contemporaneous Period Schedule Analysis are conditions precedent to the review and approval of any request for an extension in the Contract Time. Failure to complete monthly Progress Schedule updates and to participate in Contemporaneous Period Schedule Analysis will defer consideration of any time extensions by the Owner until the Work is completed and all as-built progress can be analyzed by the Owner. Further, the Owner will assess liquidated damages, if any, regardless of the status of any requests for time extensions pending, until any such requests are resolved.

1.6 SUBMITTAL SCHEDULE

- A. General: Within ten (10) calendar days following the Owner's receipt of the Baseline Progress Schedule, the Contractor shall prepare and submit to the Owner a complete schedule of work related submittals based on the Progress Schedule, as required by the Contract Documents ("Submittal Schedule"). Correlate Submittal Schedule with the listing of principal Subcontractors.
 - 1. The amount specified in Section 01 29 76 shall be withheld from the Contractor's monthly Application for Payment if the Submittal Schedule, referenced in 1.6 of this Section, is past due.
- B. Form: Prepare Submittal Schedule in chronological sequence of submittals. Show category of submittal, name of Subcontractor, generic description of work covered, related Specification Section numbers, activity or event code on the Progress Schedule baseline file, scheduled date for first submission, and blank columns for actual date of submittal, re-submittal, and final release or acceptance by the A/E. The Submittal Schedule shall be prepared in sufficient detail and in consideration of, but not limited to, the following:
 - 1. Preparation and submission of shop drawings, layout drawings, product data, material samples, and mock-ups.
- C. Update the Submittal Schedule monthly and submit to Owner.

1.7 SHORT INTERVAL SCHEDULE

- A. Short Interval Schedule: Prepare and update weekly a four (4) week Short Interval Schedule. Show previous week of actual progress (planned vs. actual performance). Forecast three (3) weeks of start and completion dates for each activity, task or event in comparison to the Progress Schedule.
 - 1. Activities in the Short Interval Schedule shall relate directly to activities in the Progress Schedule.
- B. Format for the Short Interval Schedule should be proposed by the Contractor and approved by the Owner. The format shall include comment annotation as necessary.
- C. Copies of the Short Interval Schedule shall be provided at the Construction Progress Meetings and will be used as a basis for discussion of progress and planned work at the meetings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies general administrative and procedural requirements for submittals required by the Contract Documents.
- B. Related Sections
 - 1. Section 01 33 00.11 – Submittal Standards Requirements and Compliance Review Exhibit
 - 2. Section 01 78 23.11 – Facilities Management Data Requirements for Operations and Maintenance.

1.2 SUBMITTAL PROCEDURES

- A. Coordination: Contractor shall review submittals for completeness, accuracy, and compliance with the Contract Documents, and shall coordinate the transmittal of submittals to ensure there is no delay in the construction Progress Schedule. Submittal sequencing should coincide with the Contractor's Submittal Schedule.
 - 1. Allow fourteen (14) calendar days turnaround for each submittal, from time of receipt by the Owner. For complex submittals or submittals requiring coordination with subsequent submittals, plan additional turnaround time.
 - a. Provide a "Priority List" when submitting several submittals within a short time.
 - 1. A/E reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - 3. Submittals received from sources other than Contractor will be returned without action.
- B. Submittal Preparation: Contractor shall place a label or stamp on each submittal for processing. Include the following information on the label:
 - 1. Date
 - 2. Owner's Project name
 - 3. Name of Contractor and submittal number
 - 4. Name of the entity that prepared the submittal
 - 5. Specification reference number
 - 6. For Shop Drawing submittals, Contractor's certification that the submittal has been coordinated and reviewed for compliance with the requirements of the Contract Documents, and is approved for A/E's action.
 - 7. Where more than one option is presented within a Product Data submittal, the Contractor shall strike out all portions of the document that are not applicable to the project such that it is clear as to the exact products and options the Contractor intends to provide.
- C. Submittal Transmittal: Contractor shall include a transmittal with each submittal package.

1. Address no more than one topic, or related topics, on a single transmittal (i.e., mechanical items shall not be submitted with electrical items; miscellaneous specialties shall not be grouped; shoring shall be submitted separate from foundations).
2. Record relevant information including, but not limited to: the requested review return date (in order to maintain the construction Progress Schedule) and, for Shop Drawings, variations from the requirements of the Contract Documents.
3. Provide the minimum number of each required submittal as noted in the Contract Documents and/or as follows:
 - a. Shop Drawings: one (1) PDF
 - b. Product data: one (1) PDF
 - c. Samples: five (5) samples
 - d. Mock-ups: As required by the Contract Documents
 - e. Reference the Contract Documents for additional submittal requirements
4. Material and Color Samples: Submit samples of actual materials and colors.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit no less than four (4) variations of each sample to show approximate limits of the variations.

D. Electronic Document Format Requirements:

1. Refer to Section 01 33 00.11 – “Submittal Standards Requirements and Compliance Review Exhibit” for requirements relating to electronic files used for submittals.
2. Electronic Re-Submittal Formatting Requirements: When the Contractor is required to re-submit a Product Data submittal in an electronic file format, the Contractor shall resubmit only the updated portions of the submittal in order to aid the A/E and Owner in the review process. The Contractor shall also maintain a conformed version of the submittal that is modified as the re-submitted portions are reviewed. The Contractor shall edit the final, conformed submittal to include all modifications and corrections made during the review process into a single document. It shall not be acceptable to provide the original submittal with revisions attached. This final, conformed submittal document is intended to be included in the eO&M. Refer to Section 01 78 23 – Operation and Maintenance Data.

E. A/E's Action: Except for submittals provided for the Owner's information, the A/E will: review each submittal, mark each submittal with a uniform self-explanatory action stamp indicating action taken, and return promptly. Typically action stamps indicate:

1. Accepted without exception;
2. Subject to noted corrections;
3. Returned for re-submittal after correction; and
4. Rejected as non-compliant with the Contract Documents.

F. Compliance with Contract Documents requirements is the Contractor's responsibility.

1. A/E's approval of submittals does not relieve the Contractor from responsibility for a proper installation, compliance with applicable codes, or coordination of the Work.

2. All submittals required by the Contract Documents will be reviewed by the Owner for CAD drafting compliance, PDF compliance, and to determine completeness of the documents provided.

1.3 SHOP DRAWINGS

- A. General: Shop Drawing submittals are defined in the General Conditions and include, but are not limited to, product data, samples and mock-ups, and layout drawings.
 1. Do not reproduce Contract Documents as Shop Drawings.
 2. For CAD Shop Drawing submittals, see Section 01 77 00 "Closeout Procedures."
 3. **The actual cost of each shop drawing submittal required by Divisions 02 through 49 shall be included in the subcontract bid packages.**
- B. Product Data: Product data includes manufacturer's printed installation instructions, catalog cuts, standard color charts, rough-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Submittal of standard product data is acceptable only when specific reference to the requirements of the Contract Documents is included. Submit specially prepared manufacturer's product data when standard product data is insufficient.
 2. Mark each product data submittal and show the following information:
 - a. Compliance with specified product requirements
 - b. Compliance with any specified industry standards and testing agency standards, with testing agency labels and seals
 - c. Manufacturer's printed recommendations
 - d. Applicable choices and options
 - e. Notation of coordination requirements
 - f. Notation of dimensions established by field measurement, as appropriate
- C. Samples and Mock-ups: Samples include, but are not limited to, actual colors, materials and products to be provided. Mock-ups include field installations and partial assemblies of components.
 1. Prepare samples to facilitate review. Provide the following information:
 - a. Generic description of the sample
 - b. Source of the sample
 - c. Confirmation of availability and delivery time
 2. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.
 3. Maintain sets of approved samples and mock-ups at the Project site for quality comparisons throughout the course of construction.
- D. Layout Drawings: Drawings include, but are not limited to, fabrication and installation drawings, layouts, schematics, diagrams, schedules, patterns, and templates.

1. Submit drawings drawn to accurate scale. Indicate, at a minimum, the following information:
 - a. Dimensions
 - b. Identification of products and materials included
 - c. Compliance with product installation requirements and/or industry standards
 - d. Notation of coordination requirements
 - e. Notation of dimensions established by field measurement

E. BIM Coordinated Shop Drawings:

1. General: BIM (Building Information Modelling) shall be implemented in the coordination of this Project, per the documentation requirements of "Closeout Procedures" Section 01 77 00, 1.2 Project Record Set, as well as Section 01 33 00 – "Submittal Standards Requirements and Compliance Review Exhibit", Section 01 78 23 – "Operation and Maintenance Data", and Section 01 78 23.11 – "Facilities Management Data Requirements for Operations and Maintenance". The building information model will originate from the A/E and will be a shared resource during the design and construction of the Project. The Contractor and its Subcontractors shall collaborate with the A/E and the A/E's BIM protocols to coordinate the details of the project, to prepare Shop Drawings, to assign, gather, and transfer equipment attribute information per the Facilities Management Data Requirements for Operations and Maintenance specification, and to submit a final BIM model at closeout.
2. Contractor shall coordinate the Work and require the Subcontractors to prepare and submit BIM coordinated Shop Drawings in CAD (Computer Aided Design) format. The BIM coordinated Shop Drawings shall clearly show: the building components and how the Work is to be installed in relation to the work of the other Subcontractors; systems routings, sizes and components; space for disassembly and/or removal of major equipment requiring maintenance; access to products and equipment that require periodic maintenance including, but not limited to cable trays, pull boxes, valves, dampers, switches, motors, filters, control components; and that maintenance access is adequate and in accordance with the requirements of Authorities Having Jurisdiction.
 - a. Contractor, working through the Contractor's mechanical Subcontractor shall: coordinate the mechanical systems and equipment. The mechanical Subcontractor will at a minimum prepare drawings indicating the following:
 - 1) Planned piping layout showing valve locations and valve-stem movement
 - 2) Clearances for installing and maintaining insulation
 - 3) Access doors
 - 4) Equipment and accessory service connections and support details
 - 5) Fire-rated wall and floor penetrations
 - 6) Accessories such as sizes and location of concrete pads and bases
 - 7) Penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations
 - 8) All equipment requiring maintenance access from ladders six feet or more in height, or from scaffolding
 - b. Contractor, working through the Contractor's HVAC Subcontractor, shall indicate the location, size, and elevation of the supply and exhaust systems ductwork and diffusers; fire and smoke dampers; ventilation equipment including terminal boxes, fans, and motors with VFD's; seismic bracing, and access doors in ceilings. Equipment and dampers shall be coordinated to avoid maintenance access conflicts with built-in work below.

- c. Contractor, working through the Contractor's plumbing and piping Subcontractor, shall indicate the location, size, and elevation of piping, valves, controllers and headers, cleanouts, guides and rollers, expansion joints, seismic bracing, access doors in ceilings, and fixtures and equipment. Avoid routing plumbing through electrical and data/communications rooms.
 - d. Contractor, working through the Contractor's sprinkler Subcontractor, shall indicate the location, size, and elevation of the complete sprinkler system including supply and cross mains routing, valves, seismic bracing, and standpipes. Coordinate location of sprinkler heads on the ceiling layout plans.
 - e. Contractor, working through the Contractor's electrical Subcontractor and fire alarm Subcontractors, shall indicate the location, size, and elevation of primary distribution conduit runs, sleeves, pull boxes, junction boxes, CATV boxes, cable tray, seismic bracing, electrical equipment and panels (with working clearances), fixtures including sound system speakers and terminal cabinets.
 - 1) Unless otherwise indicated, electrical panels have priority for indicated locations. Mechanical and plumbing installations shall provide all required offsets to ensure that electrical panels are installed in the indicated locations.
3. Contractor shall arrange meetings with its Subcontractors to resolve any apparent conflicts on the coordinated Shop Drawings.
- B. Ceiling Layout Drawings: Contractor shall submit for Owner's review detailed reflected ceiling layout drawings at a scale not less than 1/8" = 1'-0" showing gypsum wallboard soffits and headers with heights, and locations of access doors, roof openings, HVAC diffusers, sprinkler heads, fire alarm devices, lights, and other ceiling mounted appurtenances.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300.11 –
SUBMITTAL STANDARDS REQUIREMENTS AND COMPLIANCE REVIEW EXHIBIT

PART 1 - GENERAL

1.1 SUMMARY

A. Description:

1. This Section specifies the standards for digital/electronic data files submitted by the Contractor relating to Operation and Maintenance (O&M) documentation, As-Built drawings, and CAD/BIM files. The Contractor shall adhere to these standards for those submissions.

B. Related Sections:

1. Section 01 33 00 – Submittal Requirements
2. Section 01 77 00 – Closeout Procedures
3. Section 01 78 23 – Operation and Maintenance Data

1.2 PORTABLE DOCUMENT FORMAT (.PDF) ELECTRONIC FILE REQUIREMENTS

- A. All portable document format electronic files shall be created as “.pdf” files from the original source files, unless otherwise approved in writing by the Owner.
- B. Documents shall be created with a resolution of not less than 300 dpi.
- C. All fonts shall be embedded in the electronic file.
- D. The “.pdf” file page sizes shall be the same as the original document page sizes if the document were printed (e.g., an original document with a page size of 24”x36” shall be created with in “.pdf” format with a page size of 24”x36”.
- E. Each document shall be submitted as a single electronic file.
- F. The documents shall not be submitted using file compression software.
- G. The Contractor shall submit “.pdf” files in a format that allows them to be searchable for text strings. Where these files are not provided with searchable formatting, the Contractor shall utilize OCR (optical character recognition) software to convert the files into a searchable format.
- H. When “.pdf” documents contain content that is divided into a Table of Contents or similar major document divisions, the Contractor shall create electronic “bookmarks” for each major document section to allow the reader to navigate through the electronic file more efficiently. The Contractor shall also create electronic bookmarks for Product Data submittals to allow efficient navigation to sections of that document that contain multiple unique products and product types.

1.3 CAD ELECTRONIC FILE REQUIREMENTS

- A. Computer Aided Design (CAD) electronic files shall be submitted in AutoCad ® “.dwg” format.
- B. Building Information Model (BIM) electronic files shall be submitted in AutoCad ® Revit © format, in a mutually agreed upon release version.

- C. Each CAD drawing file shall represent a single printed sheet and the file name shall conspicuously identify the sheet number.
- D. Organize the submittal such that the files for each discipline are arranged in a separate subfolder, clearly labeled to identify the discipline.

1.4 CAD STANDARDS

A. Title Blocks:

- 1. All sheets shall have a title block on the right-hand side of the drawing.
- 2. Title blocks shall include the following information:
 - a. Date,
 - b. Owner project number,
 - c. Project name,
 - d. Sheet name,
 - e. Sheet number,
 - f. Key plan (for floor plans),
 - g. List of revisions and corresponding dates,
 - h. Name of design firm that produced the drawing,
 - i. Architect/engineers stamp.

B. Scaling and Units:

- 1. All drawings shall have a unit measure assigned and not set to "unit-less".
- 2. All objects shall be drawn at true scale (1 to 1) for the assigned units of measurement within the model space.
- 3. No external references shall be allowed. All external references shall be "bound" to the drawing file such that it is part of the file.
- 4. CAD drawings shall indicate the boundary area of all work for the project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 15
LEED CERTIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Summary of LEED Certification Procedures for project as necessary for certification of this project through the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design version 4 for Building Design and Construction: New Construction Rating System (LEED NC v4).
2. Related performance and administrative requirements.

B. Related sections:

1. General Conditions and other Division 1 Specification Sections apply to this Section.
2. Related Sections include the following:
 - a. Section 01 25 00 Substitution Procedures
 - b. Section 01 31 19 Project Meetings
 - c. Section 01 33 00 Submittal Procedures
 - d. Section 01 33 00.11 Submittal Standards Requirements and Compliance Review Exhibit
 - e. Section 01 74 00 Construction Waste Management
 - f. Section 01 81 19 Indoor Air Quality Management
 - g. Section 01 91 00 General Commissioning Requirements (NEI)
 - h. Sustainable criteria as noted in Division 2 through 48, including but not limited to other Sections listed in Section 01 35 15.

1.2 REFERENCES

- A. LEED Building Design & Construction, New Construction version 4 (LEED NC v4) Rating System. Available as a free download from USGBC's website www.usgbc.org.
- B. LEED v4 Reference Guide for Building Design and Construction (LEED v4 BD+C Reference Guide). An essential supplement to the LEED NC v4 Rating System:
 1. A full discussion of credit and documentation requirements, green building issues, design approaches, calculation methodologies, references, definitions, case studies.
 2. Available for a fee from USGBC web site.
- C. LEED BD+C version 4.1 Rating System, Reference Guide, and other resources specific to the v4.1 pilot are available for free from the USGBC web site at <https://new.usgbc.org/leed-v41>.
- D. LEED Credit Forms: LEED On-Line with calculators and templates is available to team members at LEED-Online, <https://www.usgbc.org/leedonline/>.
- E. Sustainable Agriculture Network Standard: Certification program for sustainable agriculture practices and products, sanstandards.org.

1.3 DEFINITIONS

- A. Bio-based Materials: Bio-based materials meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Excludes hide products, such as leather and other animal skin material.
- B. Building exterior: A structure's primary and secondary weatherproofing system, including waterproofing membranes and air- and water-resistant barrier materials, and all building elements outside that system.
- C. Building interior: Everything inside a structure's weatherproofing membrane.
- D. Ceilings (product category): Includes all ceiling panels, ceiling tile, surface ceiling structures, such as gypsum or plaster, suspended systems (including canopies and clouds), and glazed skylights. Overhead structural elements (exposed, finished, and unfinished) are excluded.

- E. Chain of Custody (CoC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stages of processing, transformation, manufacturing, and distribution.
- F. Composite Wood (product category): Includes all particleboard, medium density fiberboard, hardwood veneer plywood, and structural Composite Wood not included in the flooring, Ceiling, Wall panels, or Furniture material categories.
- G. Enclosure: The exterior plus semi-exterior portions of the building. Exterior consists of the elements of a building that separate conditioned spaces from the outside (i.e., the wall assembly). Semi-exterior consists of the elements of a building that separate conditioned space from unconditioned space or that encloses semi-heated space through which thermal energy may be transferred to or from the exterior or conditioned or unconditioned spaces (e.g., attic, crawl space, basement).
- H. Environmental Product Declaration: Independently verified report based on peer-reviewed life-cycle assessment (LCA) studies that have been conducted according to a set of common product category rules (PCRs) for each product category.
- I. Extended Producer Responsibility: Extended producer responsibility (also known as a closed-loop recycling program and as product take-back) puts a used product back into the production stream. Programs can be sponsored by the product's manufacturer or other service.
- J. Flooring (product category): Includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, and other floor coverings. Subflooring is excluded.
- K. Furniture and Furnishings (product category): Stand-alone Furniture items purchased for the project, including individual and group seating; open-plan and private-office workstations; desks and tables; storage units, credenzas, bookshelves, filing cabinets, and other case goods; wall-mounted visual-display products (e.g., marker boards and tack boards, excluding electronic displays); and miscellaneous items, such as easels, mobile carts, freestanding screens, installed fabrics, and movable partitions. Hospitality Furniture is included as applicable to the project. Office accessories, such as desktop blotters, trays, tape dispensers, waste baskets, and all electrical items, such as lighting and small appliances, are excluded.
- L. General Emissions Evaluation: Testing of a product's VOC content to determine compliance with the California Department of Public Health (CDPH) Standard Method.
- M. Insulation (product category): Includes all thermal and acoustic boards, batts, rolls, and blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed Insulation. Insulation for HVAC ducts and plumbing piping are excluded.
- N. LEED (Leadership in Energy and Environmental Design): Green building rating system developed by the US Green Building Council. The system certifies four levels (Certified, Silver, Gold and Platinum) of environmental achievement based on a point and credit scoring system
- O. Local Materials: Materials that are extracted AND manufactured AND purchased from within 100 miles of Project location. Manufacturing refers to final assembly of components into building product that is installed at Project site. For composite products where a portion of total materials are regional; track the regional percentage.
- P. LEED Credit Form: PDF-based forms to be completed for submittals, as specified by this Section, available at LEED Online site for project.
- Q. Material Ingredient Reporting: A manufacturer's report demonstrating the chemical inventory of a product or material to at least 0.1% (1000 ppm), using an approved program.
- R. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.
- S. Post-Consumer Recycled Content: Percentage of waste material by weight available from consumer waste that has been used as a raw material (feedstock) in a building material.
- T. Pre-Consumer Recycled Content: Percentage of waste material by weight available from industrial use incorporated into a building material.
- U. Product and Material Cost: Includes all permanently installed building products.

1. MEP, specialty equipment, and items purchased for temporary use on the project are excluded.
 2. Furniture and furnishings are not required to be included; however, they must be included if they are also included in MR BPDO EPDs and MR BPDO Material Ingredients.
 3. Includes all taxes and expenses incurred by the contractor to deliver the material to the project site, but excludes cost for labor and equipment required for installation after the material is delivered to the site.
 4. Equals cost per item times number of items purchased.
 5. The cost of salvaged, reused or reclaimed materials is either the actual cost paid or the replacement value, whichever is higher.
- V. Sustainable Wood: Wood materials that are certified under the Forest Stewardship Council and have a CoC that tracks each product from source or location of harvesting to the distributor. "Wood" also includes bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms).
- W. Volatile Organic Compounds (VOC): Organic compounds that easily become vapors or gases. Along with carbon, they contain elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur or nitrogen.
- a. For Paints, VOC content does not include water or tint added at the point of sale.
- X. Wall Panels (product category): Includes all finish wall treatments (wall coverings, wall paneling, wall tile), surface wall structures such as gypsum or plaster, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
- Y. Definitions of other terms related to individual LEED credits: Refer to LEED v4 BD+C Reference Guide.

1.4 LEED CERTIFICATION PROCEDURES

- A. Integrate sustainable building materials and methods into Work as required to meet or exceed LEED NC v4 Silver Level certification from US Green Building Council.
1. Satisfy prerequisites and credits applicable to Work of this Contract
 2. Submit documentation that demonstrates this performance.
 3. Participate as necessary to complete LEED certification application.
 4. Conform to documentation requirements for LEED certification.
 5. Adhere to the LEED Minimum Program Requirements (MPRs), including MPR #1 – Must Comply with Environmental Laws:
 - a. The LEED project building or space, all other real property within the LEED project boundary, and all project work must comply with applicable federal, state, and local building-related environmental laws and regulations in place where the project is located.
- B. Refer to Contract Documents for incorporated sustainable/environmental requirements provisions.
- C. Substitutions: Conform to provisions of Section 01 25 00 – Substitution Procedures.

1.5 CONTRACTOR REQUIREMENTS

- A. Coordinate and assist with documentation for LEED certification.
- B. Designate a LEED Representative, responsible for:
1. Implementation, coordination, and documentation of specified LEED requirements.
 2. Attend LEED related meetings during construction.
 3. Be present on-site during times that LEED related work is in progress.
- C. Submit LEED information and Final Submittal in electronic format for inclusion in certification application to USGBC through LEED Online.
1. Maintain local copies of back-up documentation if further information is requested from GBCI reviewers.
- D. Maintain copy of LEED v4 BD+C Reference Guide at project site construction office.
- E. **LEED Training Program**: The Contractor shall establish, manage, and implement a written Project specific LEED-procedures training program, and provide all necessary and appropriate instruction for its employees,

and its Subcontractors of any tier, prior to their performance of Work at the Project Site in order to ensure the LEED requirements of the Project are met.

1. Coordinate and attend LEED Construction Kickoff Meeting to review LEED credits included in the project, methods, products and materials, tracking, and submittals for the project.
2. Arrange and conduct LEED Certification review meetings at least **once a month**
 - a. Submit schedule of LEED Review Meetings to Architect for review within **fourteen calendar days** of Notice to Proceed.
 - b. For convenience, Contractor may combine with project meetings as specified Section 01 31 19, or at other times coordinated with Architect

1.6 SUBMITTAL PREREQUISITES

- A. Conform to following as required for LEED documentation of Contractor-responsible LEED credits.
- B. Submit LEED Credit Forms and related documents directly to the Green Building Certification Institute (GBCI) via LEED Online.
- C. **Within fourteen days** after receipt of Notice of Award and prior to waste removal by Contractor from Project, develop and submit to Owner for review of:
 1. Construction & Demolition Waste Management Plan: Refer to Section 01 74 00.
 2. Construction IAQ Management Plan: Refer to Section 01 81 19.
- D. Progress Report Submittals:
 1. Confirm compliance for LEED credits at least **every two months**, as specified under Submittals, by submitting a progress report that includes updated submittals.
 2. Submit new Progress Report with each Application for Payment.
 3. Include data indicating actual cost for materials purchased to date and include estimates for final material lists and costs.
- E. Final Submittals: Submit final submittals within **60 days** of Substantial Completion. For listed products, include complete product and supplier contact information.
 1. Include relevant LEED Submittal Coversheet (Figure 2 below) with all submittals.

1.7 SUBMITTALS

- A. Submit following in conformance to Section 01 33 00 – Submittal Procedures, and Section 01 33 00.11 Submittal Standards Requirements and Compliance Review Exhibit.
- B. Provide a statement showing the total cost for materials used for the Project, excluding overhead, labor, and profit. Breakout the costs of the following items
 1. Total construction cost for the project including Divisions 3-10, 31 60 00, 32 10 00, 32 30 00, and 32 90 00 only.
 2. Total materials cost, excluding labor and equipment.
 3. Additional breakout of costs by material category as required to complete the BPDO Calculator Materials Tab.
- C. Include relevant LEED Materials Submittal Forms (Figure 2 below) with all submittals.
- D. Electronic spreadsheet files for LEED Credit Forms will be available through this project's section of LEED Online website (<https://www.usgbc.org/leedonline/>).
- E. SS Prerequisite: Construction Activity Pollution Prevention.
 1. Date-stamped photos of in-place erosion and sediment control measures taken, including any corrective action. Photos should be taken at regular intervals and show all areas of the site covered in the ESC Plan.
 2. Contractor declaration confirming that the ESC plan was carried out appropriately.

3. ESC implementation narrative, providing a description of how the ESC plan was implemented, including the timing of the implementation plan, specific control measures applied on site, and the maintenance protocol used to ensure the proper function of control measures.
- F. MR Prerequisite Construction & Demolition Waste Management (CDWM) Planning
1. A CDWM Plan that complies with Section 01 74 00.
 2. Final report detailing all major waste streams generated, including disposal and diversion rates, diversion methods and facilities per Section 01 74 00.
 3. Completed LEED Credit Form that includes a tabulation of total waste materials and quantity diverted, using consistent unit of measurement.
 4. Support documentation:
 - a. Documentation of recovery rate (if commingled).
 - b. Waste hauling certificates or receipts.
- G. MR Credit Construction & Demolition Waste Management (CDWM)
1. Completed LEED Credit Form including:
 - a. Option 1: Diversion
 - 1) Completed CDW Calculator
 - 2) Total number of waste streams and diversion rate.
 - 3) Narrative of diversion strategies prior to using waste-to-energy diversion.
 - 4) Waste-to-energy documentation per Section 01 74 00
- H. MR Credits Building Product Disclosure & Optimization (BPDO): Environmental Product Declarations (EPD), Sourcing of Raw Materials, and Material Ingredients:
1. Completed BPDO Calculator Materials Tab, including all products specified with BPDO criteria, including Environmental Product Declarations (EPD); Sourcing of Raw Materials; and/or Material Ingredients. Include identification of manufacturer and material cost by line item.
 2. Complete the LEED Materials Submittal Form for Building Product Disclosure & Optimization (provided at the end of this Section) for all submittals.
 3. MR Credit BPDO: EPD, Option 1
 - a. Completed BPDO Calculator EPD Tab
 - b. For each product provide a summary of the EPD, the full EPD document or a reference to the website where the publicly-available EPD can be accessed. Highlight relevant sections.
 4. MR Credit BPDO: Sourcing of Raw Materials: Responsible Sourcing of Raw Materials
 - a. Completed BPDO Calculator Sourcing of Raw Materials Tab
 - b. Complete the LEED Submittal Coversheet for Building Product Disclosure & Optimization (provided at the end of this Section) for all submittals.
 - c. Supporting documents (cutsheets, literature, etc.) demonstrating that products meet at least one of the responsible sourcing and extraction criteria: Extended Producer Responsibility, Bio-based Materials, Wood Products, Materials Reuse, Recycled Content.
 - 1) For Extended Producer Responsibility: Documentation detailing takeback program, with proof that product purchased for project is included in the program.
 - 2) For bio-based products: Documentation of compliance with either ASTM Test Method D6866, or the Sustainable Agriculture Network's Sustainable Agriculture Standard.
 - 3) For FSC wood products: Chain of custody documentation for FSC wood products.
 - 4) For recycled content: Documentation showing percentages of post-consumer and/or post-industrial content, based on weight.
 - d. For Regional Content: For products meeting at least one of the responsible sourcing and extraction criteria, and which are also extracted, manufactured, and purchased within 100 miles of the project site, provide documentation showing product source location (extraction, manufacture, and purchase).

5. MR Credits BPDO: Material Ingredients Option 1: Material Ingredient Reporting
 - a. Completed BPDO Calculator Material Ingredients Tab Option 1
 - b. Complete the LEED Submittal Coversheet for Building Product Disclosure & Optimization (provided at the end of this Section) for all submittals.
 - c. Provide documentation of chemical inventory for all products contributing toward credit compliance. The inventory can be provided by the manufacturer, Health Product Declaration, Cradle to Cradle certification, Declare, UL Product Lens or another USGBC-approved program.
- I. IEQ Credit: Construction Indoor Air Quality Management Plan
 1. Completed LEED Credit Form for this credit declaring that credit requirements have been met.
 2. Final IAQ Management Plan per Section 01 81 19.
 3. Provide date-stamped photos labeled with strategy highlighting the implemented construction IAQ practices demonstrating the SMACNA measures.
 4. If permanently installed air handling units were operated during construction, provide:
 - a. Location of AHUs used.
 - b. Provide cutsheets with manufacturer, model, and MERV rating of filters used at return air grilles during construction.
 - c. Pre-occupancy filter replacement date and MERV rating.
- J. IEQ Credit: Indoor Air Quality Assessment
 1. Completed LEED Credit Form declaring that credit requirements have been met.
 2. Air Testing Report per 01 81 19, or Flush Out plan per 01 81 19.
- K. IEQ Credit: Low-Emitting Materials
 1. Completed LEED Credit Form declaring that credit requirements have been met.
 2. Complete the LEED Submittal Coversheet (included at the end of this Section) for all product submittals.
 3. Completed LEED Low-Emitting Materials Calculator, which must include a list of Paints, Coatings, Flooring, Composite Wood, Ceilings, and Insulation or installed onsite within the building's weatherproofing system, with product name, manufacturer, applicable emissions evaluation, VOC content, and allowed VOC limit per LEED requirements.
 - a. For each of the applicable products, submit cut sheets, MSDS, or letters from product manufacturers clearly showing TVOC levels or range, testing standard used, and VOC level.

PART 2 PRODUCTS

- 2.1 Comply with LEED requirements as noted in Technical Sections. Any Substitution requests must state whether or not proposed change impacts LEED requirements.
- 2.2 MR Credit BPDO: EPD, Option 1: Environmental Product Declaration (EPD)
 - A. Provide 20 products from at least five different manufacturers that meet one of these disclosure criteria:
 1. Life-Cycle Assessments and Environmental Product Declarations (valued as 1 product):
 - a. Publicly available, critically reviewed LCA conforming to ISO 14044, and with at least a cradle to gate scope.
 - b. Product-specific Type III EPD -- Internally Reviewed. Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product-specific internal EPDs that conform to ISO 14025, and EN 15804 or ISO 21930, and have at least a cradle to gate scope.
 - c. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs that conform to ISO 14025, and EN 15804 or ISO 21930, and have at least a cradle to gate scope.
 2. EPDs that conform to ISO 14025, and EN 15804 or ISO 21930, ISO 14071 and have at least a cradle to gate scope (valued as 1.5 products):

- a. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator.

3. Contractor is responsible for procuring adequate number of qualifying products for credit achievement.

2.3 BPDO: Sourcing of Raw Materials: Responsible Sourcing of Raw Materials

- A. Provide products sourced from at least five different manufacturers that meet one or more of the criteria below for at least 40%, by cost, of the total value of permanently installed building products in the project:
 1. Extended producer responsibility: Submit documentation detailing takeback program, with proof that product purchased for project is included in the program (valued at 50% of cost).
 2. Bio-based materials: Submit documentation verifying bio-based product/material was tested using ASTM Test Method D6866 (valued at 50% of cost), or meets the Agriculture Network's Sustainable Agriculture Standard (valued at 100% of cost).
 3. FSC wood products: Submit chain of custody documentation on final invoice (valued at 100% of cost).
 4. Materials reuse: Submit documentation indicating origin, age, and cost of salvaged, refurbished, or reused products (valued at 200% of cost).
 5. Recycled content: Submit documentation indicating postconsumer and pre-consumer recycled content percentage and cost (valued at 100% of cost).
 6. For products extracted, manufactured and purchased/distributed within 100 miles of the project site: Submit City/State/Country of material extraction, and distance from each location to project site.
- B. Products proposed for substitution must meet original product LEED specification criteria to meet 20% threshold.
- C. Contractor is responsible for procuring adequate number of qualifying products for credit achievement.

2.4 MR Credits BPDO: Material Ingredients Option 1: Material Ingredient Reporting

- A. Products in the Technical Sections have been specified to achieve this credit, using at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm): Manufacture Inventory; Health Product Declaration; Cradle to Cradle; Declare; UL Lens Certification; or USGBC approved program.
 1. Submit any third-party verification that includes content inventory, for any of the programs listed (valued as 1.5 products).
- B. Contractor is responsible for procuring adequate number of qualifying products for credit achievement.

2.5 LOW EMITTING MATERIALS (INTERIOR USE ONLY)

- A. Products defined as Paints and Coatings, Flooring, Composite Wood, Ceilings, and Insulation in 1.3 DEFINITIONS must comply with the following requirements, as applicable:
 1. Inherently non-emitting sources: Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface Coatings, binders, or Sealants.
 2. General Emissions Evaluation: Flooring, Ceilings, and Insulation must be tested and determined compliant with the California Department of Public Health (CDPH) Standard Method v1.1-2010 or later, using the applicable exposure scenario. The default scenario is the private office scenario.
 - a. Manufacturer or third-party certification must state exposure scenario used to determine compliance.
 - b. Claims of compliance for wet-applied products must state the amount applied in mass per surface area.
 - c. Manufacturers' claims of compliance must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.1-2010 or later:

- 1) 0.5 mg/m³ or less;
 - 2) between 0.5 and 5.0 mg/m³; or
 - 3) 5.0 mg/m³ or more.
3. VOC Content: In addition, all on site wet-applied materials (Paints and Coatings) installed within the project weather barrier must meet applicable VOC content limits:
- a. Paints and Coatings on site wet-applied and installed within the project weather barrier must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, per Table 1 VOC Limits - Wet Applied Paints & Coatings.
 - b. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
 - c. Methylene chloride and perchloroethylene may not be intentionally added in Paints, Coatings.
4. Formaldehyde Emissions Evaluation: Structural and Non-structural composite wood products must meet the following formaldehyde emissions evaluation, by cost or surface area.
- a. Non-structural Composite Wood products must meet one of the following:
 - 1) EPA TSCA Title VI or California Air Resources Board (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) or no added formaldehyde (NAF) resins. See Table 2 Urea Formaldehyde Limits for Ultra-Low-Emitting Formaldehyde (ULEF) Resins.
 - 2) Tested per EN 717-1:2014 for formaldehyde emissions and complies with emissions class E1.
 - b. Structural Composite Wood products must use moisture resistant Adhesives meeting ASTM D2559, have no surface treatments with added urea-formaldehyde resins or Coatings, and certification of compliance with industry standard for that product type.
 - 1) Plywood: compliant in accordance with Voluntary Product Standard - Structural Plywood (PS 1-09), Voluntary Product Standard – Performance Standard for Wood-Based Structural-Use Panels (PS 2-10), or one of the standards considered by CARB to be equivalent to PS 1 or PS 2: (AS/NZS 2269, EN 636 3S (including CE label), Canadian Standards Association CSA O121 for Douglas fir plywood, CSA O151 for Canadian softwood plywood, for CSA O153 Poplar plywood, or CSAO325 for Construction sheathing)
 - 2) Oriented strand board: specified with the Exposure 1 or Exterior bond classification in accordance with Voluntary Product Standard – Performance Standard for Wood-Based Structural-Use Panels (PS 2-10)
 - 3) Structural composite lumber: compliant in accordance with Standard Specification for Evaluation of Structural Composite Lumber Products (ASTM D 5456-13)
 - 4) Glued laminated timber: compliant in accordance with Structural Glued Laminated Timber (ANSI A190.1-2012)
 - 5) I-joists: compliant in accordance with Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists (ASTM D 5055-13)
 - 6) Cross-laminated timber: compliant in accordance with Standard for Performance-Rated Cross-Laminated Timber (PRG 320-15)
 - 7) Finger-jointed lumber: labeled “Heat Resistant Adhesive (HRA)” in accordance with the American Softwood Lumber Standard (DOC PS-20 2015)
5. The thresholds of compliance by product category are listed below:
- a. Wet-applied products:
 - 1) 75%, by volume or surface area, of products defined as Adhesives and Sealants applied on-site and inside the weather barrier must meet the General Emissions Evaluation.
 - 2) 75%, by volume or surface area, of products defined as Paints and Coatings applied on-site and inside the weather barrier must meet the General Emissions Evaluation.
 - 3) 100% of products defined as Paints and Coatings wet-applied on site must meet the applicable

VOC limits.

- b. Flooring: 90%, by cost or surface area, of products defined as Flooring must meet the General Emissions Evaluation.
 - c. Insulation: 75%, by cost or surface area, of products defined as Insulation must meet the General Emissions Evaluation.
 - d. Ceilings: 90%, by cost or surface area, of products defined as Ceilings must meet the General Emissions Evaluation.
 - e. Composite Wood: 75%, by cost or surface area, of products defined as Composite Wood must meet the applicable formaldehyde emissions evaluation.
6. Refer to USGBC Compliant Third Party Certifications and Labels for Low Emitting Materials for updates and most current program dates and documents: <http://www.usgbc.org/resources/low-emitting-materials-third-party-certification-table>.

Table 1 VOC Limits - Wet Applied Paints & Coatings

Coating Category	VOC Limit in grams per liter (g/L)*
Flat Coatings	50
Nonflat Coatings	50
Nonflat - High Gloss Coatings	150
Specialty Coatings	
Aluminum Roof Coatings	400
Basement Specialty Coatings	400
Bituminous Roof Coatings	50
Bituminous Roof Primers	350
Bond Breakers	350
Concrete Curing Compounds	100
Concrete/Masonry Sealers	100
Default	50
Dry Fog Coatings	50
Faux Finishing Coatings	
Clear Topcoat	100
Decorative Coatings, Glazes & Japan	350
Trowel Applied Coatings	50
Fire Resistive Coatings	150
Floor Coatings	50
Form-Release Compounds	100
Graphic Arts Coatings (Sign Paints)	200
High Temperature Coatings	420
Industrial Maintenance Coatings	250
Industrial Maintenance (IM) Coatings	100
Low Solids Coatings	120
Magnesite Cement Coatings	450
Mastic Texture Coatings	100
Metallic Pigmented Coatings	150
Multi-Color Coatings	250
Pre-Treatment Wash Primers	420
Primers, Sealers, and Undercoaters	100
Reactive Penetrating Sealers	350
Recycled Coatings	250
Rust Preventative Coatings	100
Sacrificial Anti-Graffiti Coatings	50
Shellacs: · Clear	730
Shellacs: · Opaque	550
Specialty Primers, Sealers, and Undercoaters	100

Stains	100
Stone Consolidants	450
Swimming Pool Coatings	340
Tile and Stone Sealers	100
Tub and Tile Refinish Coatings	420
Waterproofing Membranes	100
Wood Coatings	275
Wood Conditioners	100
Wood Preservatives	350
Zinc-Rich Primers	340
Color Added To	
Architectural Coatings, Excl. IM Coatings	50
Solvent-Based IM	600
Waterborne IM	50

*If product information lists multiple uses, the lowest VOC limit shall apply; except for Coatings described in part as a flat Coating, nonflat Coating, primer, sealer and undercoater, or represented for use on flooring and meets the definition of the category for which there is a higher VOC limit, per SCAQMD #1113.

Table 2 Urea Formaldehyde Limits for Ultra-Low-Emitting Formaldehyde (ULEF) Resins

	Particleboard	MDF	Thin MDF
ULEF-target	0.05 ppm	0.06 ppm	0.08 ppm
ULEF-cap	0.08 ppm	0.09 ppm	0.11 ppm

EXECUTION

2.6 LEED COMPLIANCE - GENERAL

- A. Meet LEED Prerequisites and Credits as identified in the LEED Checklist in Figure 1 at the end of this Section, as required for achieving LEED Certification.
- B. Prior to beginning Work of this Contract, verify construction conditions as acceptable to achieve LEED Credit and Prerequisite requirements.
- C. Correct non-conforming work failing to meet LEED requirements at Contractor's expense.

2.7 COORDINATION

- A. Coordinate with all subcontractors per Section 01 74 00.
 1. Coordination shall include review of this Section 01 35 15 and related sections.
 2. Include subcontractors in related meetings, including LEED meetings, per Section 01 31 19.

2.8 EROSION & SEDIMENTATION CONTROL

- A. SS Prerequisite Construction Activity Pollution Prevention: Conform to intent of this Prerequisite, Civil Drawings, and provisions of Division 31, including Section 31 11 00, 31 22 00, 31 23 00.

2.9 IAQ MANAGEMENT DURING CONSTRUCTION

- A. IEQ Credit Construction IAQ Management: Conform to Section 01 81 19 - Construction Indoor Air Quality Management.

2.10 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

- A. MR Prerequisite Construction and Demolition Waste Management Planning and MR Credit Construction and Demolition Waste Management: Meet objectives and diversion rates established in the Construction and Demolition Waste Management Plan; see Section 01 74 00.

2.11 COMMISSIONING

- A. EA Prerequisite and EA Credit for Enhanced Commissioning: Conform to Commissioning Plan as designated by Commissioning Authority. See Section 01 91 00.

2.12 INNOVATION

- A. TBD

Points (YES)	Points (MAYBE)	Points (NO)	design/cons.	Name and Descriptions of Credit <small>Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80 points and above</small>	Progress/Status	Assignee	Due
53	21	20		Minimum Program Requirements and Project Information Forms			
0	0	1	possible points:	Integrative Process			
3	0	13	possible points:	Location and Transportation			
		16	d	C1- LEED Neighborhood Development location	Not Pursuing	O'Brien360	
		1	d	C2- Sensitive Land Protection	Not Pursuing	Architect	
		2	d	C3- High Priority Site	Not Pursuing	Architect	
		5	d	C4- Surrounding Density & Diverse Uses	Not Pursuing	O'Brien360	
		5	d	C5- Access to Quality Transit (v4.1)	Not Pursuing	O'Brien360	
1			d	C6- Bicycle Facilities (v4.1)	Committed	Architect	CD
1			d	C7- Reduced Parking Footprint (v4.1)	Verified	Architect	CD
1			d	C8- Electric Vehicles (v4.1)	Committed	Architect	CD
9	1	0	possible points:	Sustainable Sites			
YES			c	P1 - Construction Activity Pollution Prevention	Committed	Civil	
1			d	C1 - Site Assessment	Committed	O'Brien360	CD
2			c	C2 - Protect or Restore Habitat (v4.1)	Committed	Civil	
1			d	C3 - Open Space (v4.1)	Committed	Landscape	
2	1		d	C4 - Rainwater Management (v4.1)	Action Required	Civil	CD
2			d	C5 - Heat Island Reduction	Action Required	Landscape	CD
1			d	C6 - Light Pollution Reduction	Committed	Electrical	
6	1	4	possible points:	Water Efficiency			
YES			d	P1 - Outdoor Water Use Reduction (30% reduction required)	Committed	Landscape	
YES			d	P2 - Indoor Water Use Reduction (20% reduction required)	Committed	Mechanical	
YES			d	P3 - Building Level Water Metering	Committed	Mechanical	
2			d	C1 - Outdoor Water Use Reduction (100% reduction target)	Committed	Landscape	
3	1	2	d	C2 - Indoor Water Use Reduction (40% reduction target)	Action Required	Mechanical	CD
		2	d	C3 - Cooling Tower Water Use	Not Pursuing	Mechanical	
1			d	C4 - Water Metering	Action Required	Mechanical	CD
15	8	10	possible points:	Energy Efficiency			
YES			c	P1 - Fundamental Commissioning & Verification	Action Required	CxA	CD
YES			d	P2 - Minimum Energy Performance (5% reduction required)	Action Required	Mechanical	CD
YES			d	P3 - Building Level Energy Metering	Committed	Mechanical	
YES			d	P4 - Fundamental Refrigerant Management	Action Required	Mechanical	CD
3		3	c	C1 - Enhanced Commissioning	Decision Needed	Architect	02/01/21
12	2	4	d	C2 - Optimize Energy Performance (20% reduction target)	Action Required	Mechanical	CD
	1		d	C3 - Advanced Energy Metering	Action Required	Mechanical	CD
		2		C4 - Demand Response	Not Pursuing	Mechanical	
	2	1	d	C5 - Renewable Energy	Decision Needed	Electrical	CD
	1		d	C6 - Enhanced Refrigerant Management	Action Required	Mechanical	CD
	2		c	C7 - Green Power and Carbon Offsets - (Does not apply if pursuing v4.1 under C5)	Decision Needed	O'Brien360	CD
4	4	5	possible points:	Materials & Resources			
YES			d	P1 - Storage & Collection of Recyclables	Committed	Architect	
YES			c	P2 - C&D Waste Management Planning	Committed	General Contractor	CD
		5	d	C1 - Building Life-Cycle Impact Reduction (v4.1)	Not Pursuing	Architect	
1	1		c	C2 - Environmental Product Declaration (v4.1) (20 products, 5 mfr.)	Committed	Architect	CD
1	1		c	C3 - Sourcing of Raw Materials (v4.1) (20% total product value)	Committed	Architect	CD
1	1		c	C4 - Material Ingredients (v4.1) (20 products, 5 mfr.)	Committed	Architect	CD
1	1		c	C5 - C&D Waste Management Planning (v4.1)	Committed	General Contractor	CD
13	1	2	possible points:	Indoor Environmental Quality			
YES			d	P1 - Minimum Indoor Air Quality Performance	Action Required	Mechanical	CD
YES			d	P2 - Environmental Tobacco Smoke (ETS) Control (v4.1)	Committed	Architect	CD
2			d	C1 - Enhanced IAQ Strategies	Action Required	Mechanical	CD
3			c	C2 - Low-Emitting Materials (v4.1) (4 Categories)	Committed	General Contractor	CD
1			c	C3 - Construction IAQ Management Plan	Committed	General Contractor	CD
2			c	C4 - Indoor Air Quality Assessment (v4.1)	Committed	Architect	CD
1			d	C5 - Thermal Comfort	Action Required	Mechanical	CD
2			d	C6 - Interior Lighting	Action Required	Electrical	CD
1	1	1	d	C7 - Daylight (v4.1) (Targeting 55% with one test)	Action Required	Architect	CD
1			d	C8 - Quality Views (Min 75% occupied spaces. Target 90% for EP)	Action Required	Architect	CD
		1	d	C9 - Acoustic Performance (v4.1)	Not Pursuing	Architect	
1	3	2	possible points:	Innovation in Design			
	1		d	C1 ID: Exemplary Performance Credit for Quality Views	Action Required	O'Brien360	CD
	1		d	C3 ID: Green Building Education	Decision Needed	O'Brien360	CD
	1		d	C4 ID: LEED O&M Starter Kit	Decision Needed	O'Brien360	CD
		1	d	C2 ID: Exemplary Performance Credit - TBD	Not Pursuing	O'Brien360	CA
		1	d	C5 ID: TBD Innovation or Pilot Credit	Not Pursuing	O'Brien360	
1			c	C6 - LEED Accredited Professional	Committed	O'Brien360	
2	3	1	possible points:	Regional Priority			
1			c	RPC 1 - Environmental Product Declarations (v4.1) point threshold 1 point	Committed	Architect	CD
	1		d	RPC 2 - Indoor Water Use Reduction - point threshold 4 points	Action Required	Mechanical	CD
		1	d	RPC 3 - Demand Response - point threshold 2 points	Not Pursuing	O'Brien360	CD
	1		d	RPC 4 - Renewable Energy (v4.1) point threshold 2 points	Decision Needed	O'Brien360	CD
	1		d	RPC 5 - Rainwater Management (v4.1) point threshold 3 points	Action Required	O'Brien360	CD
1			c	RPC 6 - Sourcing of Raw Materials (v4.1) point threshold 1 point	Committed	O'Brien360	CD

Figure 1: LEED Checklist

Figure 2: LEED Submittal Coversheet

01 35 00

SECTION 013523 – OWNER SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies minimum requirements for safety on the construction site including:
 - 1. Contractor responsibility (regarding safety)
 - 2. Contractor safety program and plan submittals
 - 3. Contractor safety requirements
 - 4. Contractor safety reporting
 - 5. Construction “fire safety” requirements
 - 6. Chemical hazard communication
- B. For additional provisions related to safety precautions, refer to the General Conditions.

1.2 CONTRACTOR RESPONSIBILITY

- A. The Contractor is solely and completely responsible for compliance with all applicable laws, codes and regulations regarding safety (whether noted in this Section or not) and for creating and maintaining a safe working environment, including safety of all persons and property on the jobsite (whether the requirements of this Section address a particular situation or not).
- B. The Contractor shall maintain the jobsite and perform the Work in a manner which meets or exceeds statutory and regulatory requirements for the provision of a safe place to work and which minimizes safety risks to personnel of the Contractor, Subcontractors, Owner, general public or other parties. This obligation shall apply continuously and not be limited to normal working hours.
 - 1. The Contractor shall ensure that all Contractor and Subcontractor personnel are provided sufficient training, and shall take such actions as are necessary to maintain a safe environment on the construction site. Such training and actions shall include, but not be limited to, ensuring that such employees are familiar with governing construction safety requirements and the requirements for compliance with applicable regulations.
 - 2. The Contractor shall monitor the jobsite to ensure that employees do not create unsafe conditions for others, and to comply with the provisions of the Site Specific Safety Plan.
 - 3. The Contractor shall establish and communicate clear expectations to its employees and Subcontractors of any tier (and their employees) of their obligation to notify the Contractor and any at risk party of any potential health or safety hazard affecting themselves or others.
 - 4. The Contractor shall conduct on-site safety meetings weekly, or other frequency as appropriate, that shall be mandatory for all employees.
- C. The Contractor shall designate one on-site competent individual(s) to be the “Safety and Health Officer” who is qualified and authorized to supervise and enforce compliance with the Contractor’s Site Specific Safety Plan during the performance of the Work. The Contractor is responsible to ensure that all necessary monitoring equipment, protective clothing, and other supplies and equipment are available to implement the Plan. **The Contractor’s Safety and Health Officer(s), Company Safety Program (see Section 1.3A below), Site Specific Safety Plan (see Section 1.3B below), and all related equipment, clothing, supplies, and other items required to designate the Officer(s) and implement the Program and Plan are a Specified General Conditions cost.**

1. The Contractor shall require each Subcontractor to provide an on-site safety manager (competent individual) for the duration of work at the Project site. If the man-load is below fifty (50) field workers, the Subcontractor may designate its Superintendent as the safety manager. If the man-load is fifty (50) or above field workers on site, the Subcontractor shall provide and designate a dedicated competent individual as safety manager whose sole responsibility is Project safety including, but not limited to: review pre-task plans, critical lift plans, rigging and installation means and methods, fall protection, trenching excavations, electrical safety, Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act of 1973 (WISHA) regulations compliance, and second tier Subcontractor safety monitoring and compliance.
- D. Safety Violations: In the event of WISHA violations by the Contractor or any of its suppliers or Subcontractors of any tier for unsafe practices involving imminent danger to personnel of the Owner, Contractor, Subcontractors, or others, the Contractor shall immediately correct the hazardous situation which caused the violation prior to any work continuing in the affected area. If such violations exist and corrective actions have not been taken by the Contractor, the Owner may order the Contractor to stop work (to be followed up in writing the same day), until satisfactory corrective action has been taken per the General Conditions.

1.3 CONTRACTOR SAFETY PROGRAM AND PLAN SUBMITTALS

- A. Company Safety Program: The Contractor shall submit a copy of its Company Safety Program to the Owner. The Company Safety Program shall contain, at a minimum, the following elements:
 1. Organizational Structure: Include names of individuals who will perform safety duties, titles, work assignments, authority and reporting relationships.
 2. Training Program: Who, how, and when training is provided; method of employee training concerning safety rules and procedures; and training in use of protective equipment.
 3. Protective Equipment: List of personal protective equipment to be provided to employees.
 4. Accident Prevention and Loss Control Plan: Work site inspection and hazard correction procedures; disciplinary procedures for safety infractions; and accident response (investigation and reporting procedures).
 5. Field Implementation and Supervision: Identify the Safety and Health Officer(s) that will lead field implementation of the Company Safety Program and Site Specific Safety Plan. The Safety and Health Officer(s) shall be on the project site at all times during the progress of the Work and as appropriate for all work subsequent to Substantial Completion. The Safety and Health Officer(s) shall have complete authority to take those actions necessary to ensure compliance with the Contractor responsibilities and safety requirements specified in this section and elsewhere in the Contract Documents.
- B. Site Specific Safety Plan: The Contractor and each of the Contractor's Subcontractors shall review the Contract Documents, and the Contractor shall develop and submit a copy of a "Site Specific Safety Plan" to the Owner. The Site Specific Safety Plan shall describe who, how, and when the Contractor's safety personnel will be deployed in the field to implement the Company Safety Program and Site Specific Safety Plan and supervise, monitor and improve Program and Plan performance. The Site Specific Safety Plan shall be tailored to the unique issues of the Project and the specific types of hazards likely to be encountered

throughout all phases of the Work, be in compliance with WISHA and all other regulatory requirements, and contain, at a minimum, the following elements:

1. Application of Company Safety Program: The Site Specific Safety Plan shall address how the elements listed in this Section 1.3A will be specifically applied and modified in addressing the unique issues related to the Project.
2. Specific Hazards: The Site Specific Safety Plan shall address, as applicable, the following, and other specific hazards for the Project:
 - a. Odor notification
 - b. Excavation and rescue plans
 - c. Pedestrian safety
 - d. Overhead hazards and flying objects
 - e. Hot works
 - f. Hazardous materials and chemical exposure
 - g. Methane abatement
 - h. Safety issues related to Owner's "Prior Occupancy"
 - i. Working over water
 - j. Rigging - aerial lifts and forklifts
 - k. Electrical safety
 - l. Scaffolding and personnel lifts
 - m. Noise and dust
 - n. Lock-out/Tag-out and control of hazardous energy
 - o. Work in confined spaces
 - p. Housekeeping and safe access
 - q. Silica
 - r. Fall prevention
 - s. Steel erection activities
 - t. Crane safety
 - u. Temporary lighting plan which is coordinated with construction phasing and logistics plan

1.4 CONTRACTOR SAFETY REQUIREMENTS

- A. Safety Training: Contractor shall provide construction site orientation for all employees (including Subcontractor employees) to become familiar with the Site Specific Safety Plan prior to commencing work. Contractor shall, on a weekly basis, perform safety training on hazards specific to the phase of work for all employees. These meetings shall be mandatory for all construction employees.
 1. Subjects should include site specific safety issues and procedures and discussion of corrections resulting from any violation in safety procedures. A log of subjects covered and a copy of the attendance records of each meeting shall be submitted to the Owner's Representative on the day the meeting occurs.
- B. Respiratory Equipment: Any personnel performing work requiring the use of respiratory protective equipment shall be fully trained in the use of such equipment. Contractor must have a respiratory protection program and ensure that all workers wearing respirators have medical clearance and fit testing, as appropriate, for the type of respirators used.
- C. Personal Protective Equipment: Contractor shall ensure all construction personnel to be equipped with and utilize personal protective equipment in accordance with Labor and Industries standards. As a minimum requirement, all personnel working on the construction site shall be required to use approved hardhats, safety glasses, and substantially constructed work boots. In addition, high-visibility safety apparel shall be worn in accordance with the

American National Standards Institute and the International Safety Equipment Association (ANSI/ISEA) standard 107-2004.

- D. First Aid: The Contractor shall maintain at the Contractor's field office, or other well known place at the Project site, all materials (e.g., a first aid kit) necessary for giving first aid to the injured, and shall establish, publish, and make known to all employees procedures for ensuring immediate removal to a hospital or a doctor's care, persons (including personnel) who may have been injured on the construction site. Construction personnel shall not work on the construction site before the Contractor has established, and made known, procedures for removal of injured persons to a hospital or a doctor's care. If the Contractor and/or any Subcontractors work crew consist of five or more employees, the Contractor shall ensure that at least one of such employees has a valid and effective first aid card.
- E. Safety Walk-through: In addition to WISHA requirements, the Contractor shall conduct a safety walk-through of the Project with the Owner's Representative a minimum of once a month during the course of construction. If a safety manager is required for any Subcontractor, the safety manager shall also attend the safety walk-through. The Contractor shall:
 - 1. Document and maintain a written record of the hazards and unsafe practices noted during the walk-through and provide copies to the Owner as requested;
 - 2. Ensure that corrective action is promptly taken to eliminate the items recorded; and
 - 3. Maintain copies of all inspections performed by other competent individuals on the construction site during the course of construction.
- F. Job Hazards Analysis: The Contractor shall plan daily work, considering procedures with the potential for personnel injury and implement appropriate practices to avoid injuries with focus on engineering controls, personal protective equipment needs, and mitigation for exposure to cuts and lacerations. At each construction progress meeting, the Contractor shall present its plan for addressing hazards likely to be encountered in the next week.
 - 1. The Contractor shall develop and implement a program requiring task planning at the foreman level, including at the Subcontractor's foremen level.

1.5 CONTRACTOR SAFETY REPORTING

- A. Reporting Injuries and Incidents: Contractor shall immediately notify the Owner's Representative of any injury or incident to persons, including personnel, on the construction site. Contractor shall conduct an immediate investigation with an emphasis on preventative actions and lessons learned. The Contractor and its Subcontractor shall document the investigation and submit a hard copy of the report on OSHA Form 301 "Injury and Illness Report," or equivalent, to the Owner within 24 hours of the incident. The Contractor shall report on a monthly basis the total number of hours worked on-site by the Contractor's employees and Subcontractors, and the total number of recordable incidents and lost time accidents. Contractor shall submit copies of the Project First Aid Log to Owner's Representative on a monthly basis.
- B. Reporting Potentially Serious Hazards: Contractor shall immediately notify the Owner's Representative of any potentially serious hazard to persons, including personnel, on the construction site. Contractor and its Subcontractor shall conduct an immediate investigation and submit a report to the Owner's Representative within 24 hours of becoming aware of the potentially serious hazard. The report shall describe the potentially serious hazard, the results of the Contractor's investigation, and any steps the Contractor has taken to prevent an injury or incident from occurring based on the potentially serious hazard.

C. Emergency Procedures:

1. For emergencies requiring an ambulance, fire department, or police assistance, the Contractor shall call emergency services (fire and police at 911).

1.6 CONSTRUCTION FIRE SAFETY REQUIREMENTS

- A. Fire Safety During Construction and Demolition: The Contractor shall conform to Chapter 14, "Fire Safety During Construction and Demolition," of the International Fire Code, as locally amended, and any additional provisions as outlined herein for precautions against fire, flammable and combustible liquids, flammable gases, explosive materials, fire protection, fire reporting, fire fighting access, means of egress, standpipes, fire sprinklers, and roofing operations.

1. The Contractor shall provide adequate separation between Owner-occupied buildings and construction trailers and sheds.

B. Hot Work Procedures:

1. Contractor shall establish a system for documentation and control of "hot work" activities which include the use of portable gas, grinding, or arc welding equipment and conduct operations in a manner that is fire-safe for the work area and adjacent areas. Hot work permits are to be posted at the jobsite in an accessible and conspicuous location. Maintain the premise clear of rubbish, debris, or other materials constituting a potential fire hazard. The local fire code is incorporated herein by reference; adhere to all applicable provisions as determined by the local fire department. Contractor and Subcontractors shall obtain from the local Fire Department engineering inspection section, a permit for all hot work activities prior to performing this Work.
 - a. Whenever practical, the Contractor shall perform cutting and welding operations off-site.
2. Maintain copies of all hot work related permits for Owner's review upon request, including, but not limited to:
 - a. Cutting and welding;
 - b. Roofing/hot-tar kettle; and
 - c. Storage of flammable materials (e.g., propane, butane) and/or compressed gases.
3. Prior to conducting hot work activities, the Contractor shall ensure all of the following fire safety precautions have been taken:
 - a. Cutting and/or welding equipment must be thoroughly inspected and found to be in good repair, free of damage or defects.
 - b. A multi-purpose dry chemical, portable fire extinguisher must be located so that it is immediately available to the area of work and is fully charged and ready for use.
 - c. At least one fire alarm pull station or means of contacting the fire department (i.e., site telephone) must be immediately available and accessible to person(s) conducting the cutting/welding operation.

- d. Floor areas under and at least 35 feet around the cutting/welding operation must be swept clean of combustible and flammable materials.
- e. All construction equipment fueling activities and fuel storage must be located at least 35 feet away from cutting/welding operations.
- f. Fire resistant shields (e.g., fire retardant plywood, flameproof tarpaulin, and metal), must cover combustible floors.
- g. Combustible materials and finished surfaces, equipment, electrical cables, and personnel must be provided with protection to prevent damage or injury from molten metal, falling sparks, and welding arcs.
- h. Spark / slag catchers (e.g., fire retardant plywood, flameproof tarpaulin, metal, etc.), must be suspended below any elevated cutting/welding operation.
- i. All floor and wall openings must be covered to prevent sparks/slag from traveling to other unprotected area.
- j. Containers in or on which cutting/welding will take place must be purged of flammable vapors.

C. Fire Systems Shutdowns, Impairments, and Fire Watch

- 1. When it is necessary to shut down existing fire alarm systems or suppression systems for switch-over purposes, or any other reason that leaves the building unprotected, the Contractor shall provide a continuous Owner-approved "fire watch" in accordance with AHJs and the following (unless the Contractor provides an Owner-approved temporary equivalent system or the Contractor is specifically excepted by the Owner):
 - a. Person(s) assigned to a fire watch must be trained in the use of the portable fire extinguisher.
 - b. Fire watch personnel must have an immediate means of providing notification to the fire department (e.g., cellular phone, land-line phone, two-way radio to a continuously staffed position).
 - c. Continuous rounds to cover all areas of the building where the fire protection system is out of service are required every 15 minutes.
 - (1) Exception for Building Code type "B occupancy" buildings: During the hours a B occupancy building is occupied, building occupants performing their duties, including construction personnel, may act as a fire watch in lieu of a designated fire watch, when approved in writing by the Owner.
 - (a) A fire watch is required at all times in unoccupied areas.
 - (b) Other building code occupancy types may be allowed this exception when approved in writing by the Owner.
 - d. A log of the rounds shall be maintained to include the name of the person performing the fire watch, the hours worked (including start and stop times), and comprehensive notes.
- 2. The Contractor shall work in cooperation with the Owner to identify fire alarm initiating devices in and adjacent to the Project site that may activate from construction activities

(i.e., work that creates dust, smoke, steam, heat, etc.) and develop a plan to temporarily cover, remove, or disable through programming these devices to eliminate the potential for false alarms.

- a. The Owner may authorize in writing some devices to be disabled for the duration of the Work or for a particular activity without requiring a continuous "fire watch" for one shift or several days depending on circumstance.
 - b. **ONLY OWNER PERSONNEL SHALL DEACTIVATE OR DISABLE EXISTING FIRE DETECTION AND SUPPRESSION SYSTEMS**, unless the Contractor is specifically authorized in writing by the Owner to do so.
- E. Fire Extinguishers Required for Construction: Provide multipurpose dry chemical portable fire extinguishers for the Work in accordance with the International Fire Code Chapter 14, as locally amended, and as required by WISHA and other applicable regulations. Existing building fire extinguishers or new fire extinguishers specified by the Contract Documents for the Project do not alleviate Contractor's responsibility to provide temporary fire extinguishers for the Work.
- H. Occupant Egress in Existing Buildings: The Contractor shall not block active exits, exit hallways, exit corridors, and the exit access to a public way.
1. Exits are to remain free of construction materials, equipment, and rubbish at all times, unless approved by Owner.
- I. Emergency Access: Outdoor storage and staging operations and construction fencing shall not impede egress; restrict or narrow fire fighting access (including roads or lanes); or present a fire exposure to existing buildings.
1. Access to emergency services including, but not limited to, fire hydrants, fire department connections, fire command centers, fire alarm panels, valves and similar equipment and systems for emergency vehicles and emergency response personnel must be kept free and unobstructed at all times, unless specifically approved by the Owner.
 2. Temporary obstruction of emergency access may be allowed for special cases (e.g., crane installations and hoisting) on a short-term basis. A written plan must be submitted to the Owner for approval at least two weeks prior to the scheduled date of obstruction.

1.7 CHEMICAL HAZARD COMMUNICATION

- A. General: The Owner and the Contractor are responsible under the Washington Administrative Code 296-800-170 through 296-800-18020 (Employer Chemical Hazard Communication) to provide a safe and healthy environment for their employees.
- B. Responsibilities:
1. The Contractor shall establish a Chemical Hazard Communication Program (WAC 296-155-180) which includes multiemployer workplaces (WAC 296-800-17007) and provide hazard communication information and training to its employees and the employees of the Contractor's Subcontractors (of any tier).
 - a. The information shall include: signage demarcating regulated areas and entrances; signage indicating where the Contractor's binder containing all MSDS

- used for Construction is located; and prominently posted lists identifying all hazardous chemicals present in the workplace.
- b. In addition to MSDS training which is regulated by the Employer Chemical Hazard Communication standard, training shall include those MSDS that are available for any Owner's chemical product present at a jobsite.
3. The Contractor shall provide the Owner chemical hazard information (MSDS) for all chemical products the Contractor and the Contractor's Subcontractor's (of any tier) bring onto the jobsite for Owner's information prior to application including, but not limited to, all paints, glues, mastics, epoxies and cleaning products.
- a. At the jobsite, the Contractor shall establish and maintain a binder(s) of all hazardous chemicals MSDS used for Construction and indicate where utilized.
 - (1) The MSDS shall be bound in a slant-D, 3-ring, view binder with clear vinyl overlay inserts on the front cover and spine. The binder shall have heavy duty nylon reinforced hinges.
 - (2) The binder shall have a cover slip sheet and a spine sheet typed with "MSDS used for Construction," Project name, Project number, A/E name, and Contractor name.
 - (3) The MSDS shall be organized by specification division and section with tabbed dividers between the sections or, when presented in a logical format by Contractor and approved by Owner, between categories.

1.8 CHEMICALS OF INTEREST REPORTING

- A. Prior to work being performed by the Contractor and/or the Contractor's Subcontractors (of any tier), the Contractor shall submit to Owner a completed "Contractor Declaration and Reporting Form for Department of Homeland Security – Chemicals of Interest" for chemicals listed in 6 CFR (Code of Federal Regulations) Appendix A to Part 27 that will be used on the jobsite. Individual declarations shall be provided by the Contractor and the Contractor's Subcontractors (see Appendix A of the Specifications for a copy of the form).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Section further describes basic Contract definitions, specification format and content explanations, and industry standards in the Contract Documents.

1.2 DEFINITIONS

- A. Accepted: The term "accepted" is used in conjunction with the A/E's duties and responsibilities as stated in the conditions of the Contract.
- B. Concealed: Spaces out-of-sight such as above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the A/E, requested by the A/E, and similar phrases.
- D. Exposed: Open to view. For example, pipe installed in a walkway tunnel or pipe installed in a room and not covered by other construction.
- E. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.
- F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference.
- G. Install: Operations at Project site to place in position for service or use including unloading, unpacking, assembly, erection, placing, anchoring, applying, working-to-dimension, finishing, curing, protection, cleaning, and similar requirements.
- H. Installer: An installer is the contractor or another entity engaged by the Contractor, either as an employee, Subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers shall be experienced in the operations they are engaged to perform.
- I. Project site: Is the space available to the Contractor for performing 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. Certain construction activities may extend beyond the Project site.
- J. Provide: Furnish and install, complete and ready for intended use.
- K. Regulations: The term "regulations" includes laws, codes, ordinances, statutes, and lawful orders issued by authorities having jurisdiction (AHJ), as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- L. Trades: Using terms such as carpentry does not 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 tradespersons of the corresponding generic name.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into divisions and sections based on the Construction Specification Institute's (CSI) MasterFormat.
1. Title: The Specifications are divided into division and section for the convenience of writing and using. The titles of these are not intended to imply a particular meaning or to fully describe the work of each division, subdivision, or section and are not an integral part of the text which specifies the requirements.
 2. Three Part Section: Each section of Specifications has been subdivided into three parts for uniformity and convenience (Part 1 – GENERAL, Part 2 - PRODUCTS, and Part 3 - EXECUTION). These do not imply a particular meaning and are not an integral part of the text which specifies requirements. Where text for one of the parts is lacking due to project requirements, the part title is included followed by the words "Not Used."

<u>Level of Indexing</u>	<u>Nomenclature</u>	<u>Letters & Punctuation</u>	<u>Identified</u>	<u>Example</u>
1st	Part	Upper Case	Numerical	PART 1 - GENERAL
2nd	Heading	Upper Case	Numerical	1.1 SUMMARY
3rd	Paragraph	Upper/Lower Case	Letter	A. General
4th	Subparagraph	Upper/Lower Case	Numerical	1. General
5th	Subparagraph	Upper/Lower Case	Letter	a. General
6th	Subparagraph	Upper/Lower Case	Numerical	(1) General

- B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. The conventions are explained as follows:
1. Abbreviated language: Abbreviated words and meanings used in the Contract Documents shall be interpreted as appropriate. Words implied, but not stated, shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicate.
 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, subjective language is used for clarify to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - a. The words 'shall be' are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: All construction shall be in accordance with industry 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 industry standards in effect as of the Bid date of the Contract Documents.

- C. Conflicting Requirements: Where compliance with two (2) or more standards are specified and where the standards may establish, different or conflicting requirements for minimum quantities or quality levels, the Contractor shall promptly report to the A/E, in writing, requesting a decision before proceeding with the Work.
 - 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, to comply with these requirements. Indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements.
- D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound within the Contract Documents.
 - 1. Where copies of standards are needed to perform 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. Acronyms or abbreviations, as referenced in Contract Documents are defined to mean the recognized name of the trade association. Names and addresses are subject to change and are believed, but not assured, to be accurate and up-to-date as of the date of the Contract Documents. Refer to the latest edition of the "Encyclopedia of Associations" published by Thomson Gale for a listing of associations and general standards abbreviations.
- F. Federal Government Agencies: Names and titles of federal government standard - or Specification -producing agencies are often abbreviated. Acronyms or abbreviations referenced in the Contract Documents may indicate names of standard - or Specification-producing agencies of the federal government. Names are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011500 – CONTRACTOR QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. General Requirements: Comply with the quality control provisions specified in the Contract Documents including this Section and perform quality control testing and inspection, and the surveillance of the Work for quality, unless specifically designated to be performed by Owner.
- B. Contractor Quality Control (CQC) shall consist of plans, procedures, and organization necessary to provide materials, equipment, workmanship, fabrication, construction, and operations that comply with the requirements of the Contract Documents. CQC shall cover construction operations keyed to the Progress Schedule including, but not limited to, fabrication on-site and off-site, and field and factory tested construction mock-ups.
- C. Owner's special inspection and testing agency services are specified in Section 01 45 23 "Testing and Inspecting Services" and may be required to ensure the Work is in accordance with the Contract Documents, except where those tests are specifically indicated to be performed by the Contractor in the Contract Documents. These services do not relieve the Contractor of responsibility for compliance with Contract Documents requirements.

1.2 CQC MEETINGS

- A. General Work Plan Meeting: Contractor shall meet with Owner's Representative and A/E to discuss CQC procedures. Items for discussion shall include, but not be limited to:
 - 1. Identification of the Contractor's CQC Representative;
 - 2. Interrelationship of Contractor, AE and Owner's Representative;
 - 3. CQC administrative procedures and pre-installation work plans;
 - 4. Submittals and persons responsible for Shop Drawing review;
 - 5. Forms for recording the CQC program;
 - 6. Testing, inspections and approvals records;
 - 7. On-site and off-site fabrication and installation procedures; and
 - 8. Field constructed mock-ups.
- B. Pre-installation CQC Work Plan Meetings: Develop a "CQC Work Plan" for each definable feature of the Work. Complete the work plan and submit to Owner with each notification requesting a pre-installation meeting. The work plan shall serve as the basis for discussion and review of the Contract Documents requirements. The work plan will assist to assure that materials and equipment delivered and assembled for construction conform to Contract requirements, and that control testing and CQC procedures are documented.
 - 1. When requested by the Owner, the Contractor shall revise a CQC Work Plan and provide the Owner a final CQC work plan with changes addressing comments or clarifications from the A/E and/or Owner's special inspection services or Commissioning Authority.

1.3 CONTRACTOR QUALITY CONTROL REQUIREMENTS

- A. Contractor's Quality Control Organization: Staff the CQC organization, as required, to perform the activities outlined in this Section and elsewhere in the Contract Documents.
 - 1. Identify a "CQC Representative" who shall be on the Project site at all times during progress of the Work, and as appropriate for all work subsequent to Substantial

Completion. The CQC Representative shall have complete authority to take those actions necessary to ensure compliance with the Contract Documents.

2. Identify persons responsible for review and approval of Shop Drawings and other submittals required by the Contract Documents.
- B. Qualifications of CQC Representative: The Contractor shall propose and Owner shall approve, in writing, the Contractor's CQC Representative. The CQC Representative must have construction management experience including prior experience with projects of similar construction, size, and complexity.
1. During progress of the Work, the Owner will monitor and evaluate the performance of the CQC Representative based on the conformance of the Work with the Contract Documents and an assessment of the accuracy, timeliness and completeness of the daily QC Report. If the CQC Representative fails to perform to the sole satisfaction of the Owner, the Contractor shall propose a replacement CQC Representative for the Owner's approval.
- D. Control of On-Site and Off-Site Construction: Contractor's Quality Control procedures shall include the following phases of control and management for each definable feature of the Work:
1. Pre-installation Meeting: A pre-installation meeting shall be held prior to beginning work on each definable feature of the Work specified in the Contract Documents (see Section 01 31 19 "Project Meetings").
 2. In-Progress Inspection Phase: In-progress quality control testing and inspection, and surveillance of the Work for quality shall be performed continuously to verify that quality standards are maintained throughout the Work. Adjustment to quality control procedures and CQC work plans may be required, based upon the results of the inspections and testing.
 - a. The Contractor shall:
 - (1) Discuss quality control procedures at construction progress meetings;
 - (2) Report the results of the inspections and any changes to quality control procedures in the daily QC Report; and
 - (3) Revise CQC work plans for Owner's records, if changes are required.
 3. Above-Ceiling Final Inspections: The Contractor shall provide to the Owner a minimum two (2) week notice prior to ceiling installations for the A/E to conduct above-ceiling final inspections.
 - a. The Contractor shall perform corrective work and provide reasonable time for the A/E to validate the work complete prior to covering from sight.
 4. Contractor's Final Punch List Report: The CQC Representative shall thoroughly inspect all aspects of the construction (including the Subcontractor's work) and produce a final punch list report of work requiring correction and/or incomplete work that shall be issued to the Subcontractors with instructions to complete prior to requesting Owner's final inspections. The Contractor's written request for Owner's final inspection shall certify that all features of the Work are installed and have been reviewed by the Contractor to determine compliance with the Contract Documents.

- a. The Contractor's final punch list report shall be prepared by the Contractor, in a format acceptable to the Owner.
 - (1) The report shall include a comprehensive Project room number list and additional entry listings for site work, building enclosure, roofs, and other items not designated with a room number to document the entire Project.
 - (2) The Owner's final inspections items will be added to the Contractors punch list report by the A/E.
 - (3) The Owner will manage the consolidated listing of all open inspection items until all items are signed-off by the Owner.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014523 – TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. General Requirements: Comply with the testing and inspection, and correction of Non-Conforming Work provisions specified in this Section and elsewhere in the Contract Documents.
- B. Owner's Responsibilities:
 - 1. The Owner will select and employ an independent "Testing Agency" to conduct the tests and inspections in accordance with applicable standard methods of the American Society for Testing and Materials (ASTM) or other standards as a requirement of the building permit.
 - 2. The Owner may provide other special inspection services to inspect and verify that the Work installed is in accordance with the Contract Documents and construction industry standards.
- C. Contractor's Responsibilities:
 - 1. All other tests and inspections which are required to obtain regulatory approval by Authorities Having Jurisdiction (AHJ) shall be provided by and paid for by the Contractor.
 - 2. The Contractor shall provide other testing services where specified in the Contract Documents.

1.2 DESCRIPTION

- A. Definition: For the purpose of this Section, all references made to Testing Agency, or waterproofing and roofing inspections, or geotechnical consulting firm shall be referred to as those tests or inspections which will be conducted by an inspector provided by the Owner.
- B. Testing and Inspection: Materials to be tested and inspected are specified by the Contract Documents. In addition, testing and inspection of other materials maybe required by the building permit or as directed by the Owner or AHJ. Quantities and extent of tests and inspections shall be as specified and/or required by the Owner's inspector or AHJ.

1.3 QUALITY ASSURANCE

- A. Qualifications: The inspector for all work of this Section, except for geotechnical and waterproofing and roofing special inspectors, shall be a registered inspector employed by an approved inspection and/or Testing Agency as listed by the Washington Association of Building Officials (WABO) Special Inspection Registration Program. All inspection personnel used on this Project are subject to being disapproved from the Project at the sole discretion of the Owner's Representative. Minimum levels of qualifications as stated in the WABO Special Inspection Registration Program for various portions of the required Testing Agency inspections and testing must be complied with.
 - 1. The special Inspector for waterproofing and roofing must have the required technical knowledge and experience for the product being installed.

2. The Owner may select a Testing Agency, other than the agency employed by the Contractor, to perform tests required by the building permit.
3. Geotechnical inspection will be performed by a licensed geotechnical consulting firm.

1.4 DUTIES OF OWNER'S TESTING AGENCY

- A. General: The Testing Agency shall conduct testing and inspection services, interpret them, evaluate the results for compliance with the building permit and the Contract Documents, and report the findings to the Owner's Representative, A/E, Contractor, and AHJ. Testing and inspection services shall be in accordance with applicable standard methods of ASTM or other standards specified by AHJ, the Contract Documents, and construction industry standards. The Testing Agency shall reasonably support overtime, second shift, and out-of-area activity if requested by the Contractor and approved at the Owner's sole discretion.
- B. Non-Conforming Work: The Owner's inspectors will document and immediately notify the Contractor and the Owner's Representative of any Work found defective or not in accordance with the requirements of the Contract Documents.
- C. The Owner's inspectors are not authorized to:
 1. Release, revoke, alter, or enlarge on the requirements of Contract Documents;
 2. Approve or accept any portion of the Work, except as allowed by the special inspection duties delegated by AHJ for building permit inspections and testing;
 3. Perform any duties of the Contractor; or
 4. Stop the Work.

1.5 COSTS

- A. The Owner's Testing Agency and special Inspector costs for initial testing and inspection as specified in the Contract Documents will be paid for by the Owner. Initial tests and inspections are defined as those required to complete the first tests and inspections specified.
- B. Additional tests and inspections not specified but requested by the Owner or A/E shall be paid for by the Owner.
 1. However, if the results of such tests and inspections are found to be not in accordance with the Contract Documents, the Contractor will be back-charged for all costs of this testing and inspection as well as re-testing, re-inspection and Owner's consultants' services.
- C. Costs for additional tests or inspections required because of a Contractor change in products or materials, or source, after a submittal has been reviewed and accepted, shall be borne by the Contractor.
- D. Costs of any testing which is required solely for the convenience of the Contractor in its scheduling and performance of the Work shall be borne by the Contractor.
- E. Costs for verification testing and inspection of Work done without timely notice, with improper supervision, or contrary to construction practice, shall be borne by the Contractor.

- F. Costs for testing of materials for which fabrication and mill reports are required, but not furnished, shall be borne by the Contractor.
- G. Costs of any testing which is the responsibility of the Contractor as specified in the Contract Documents shall be borne by the Contractor.

1.6 TESTS AND INSPECTION REPORTS

- A. Copies of Test and Inspection Reports: Electronic copies of Owner's Testing Agency (or other special inspection services) reports and Contractor's test and inspection reports shall be exchanged between Owner and Contractor at weekly intervals and shall be provided to AHJ as required. All reports will be signed by a registered engineer. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested and records of special sampling operations that are required shall also be reported.
 - 1. Submit copies of inspection reports, certifications, notices, correspondence, and similar documents and records established in conjunction with building industry standards bearing upon the Work.

1.7 CONTRACTOR'S RESPONSIBILITIES

- A. General: Inspection of the Work by the Owner's special inspectors and/or Testing Agency shall not relieve the Contractor from responsibility for compliance with Contract Documents requirements. Owner's special inspectors and/or Testing Agency and Owner's Representative shall have authority to reject Work whenever the provisions of the Contract Documents are not being complied with, and the Contractor shall instruct his employees accordingly.
- B. Coordination: The Contractor's shall initiate, coordinate, and conform to the required tests and inspections of AHJ.
- C. Access for the Purpose of Inspection: The Contractor shall ensure the Owner's special inspectors and/or Testing Agency have free access to all parts of the Work and to the shops where the Work is in preparation; are provided proper facilities for safe access for such inspection; and are reasonably furnished equipment, tools, samples, certifications, test reports, design mixes, storage, and assistance as requested by the Owner's Inspector.
- D. Storage Facilities: The Contractor shall furnish adequate facilities for the sole use of the Owner's Testing Agency to provide safe storage and curing space for test specimens that must remain on-site prior to transport to the laboratory. **The cost of storage facilities is a negotiated support service.**
- E. Data: The Contractor shall furnish accepted submittals and approved Change Orders, certificates, and similar data as may be required by Owner's inspectors to perform their work to assure compliance with the Contract Documents.
- F. Notice: Furnish notice to Owner's Representative and coordinate with Owner's inspectors. Provide a minimum of five (5) working days notice in advance of all required tests and a minimum of forty-eight (48) hours in advance of all required inspections, unless otherwise specified.
- G. Cancellations: Contractor shall give sufficient advance notice to Owner's Representative and Inspectors to allow rescheduling of their work load in the event of cancellation or time extension of any scheduled test or inspection.

1. Any charges from an Inspector due to insufficient advance notice of cancellations or time extensions shall be borne by the Contractor, at the Owner's sole discretion.

1.8 TEST FAILURES

- A. General: The Owner's Representative may require a re-test of a sampled material when a sample or procedure has failed to pass the required tests. In such cases, two samples shall be tested and the material shall be rejected if either sample fails.
 1. In the event any test or inspection indicates failure of a material or procedure to meet the requirements of the Contract Documents, all costs for re-testing or re-inspection shall be borne by the Contractor.

1.9 REPORTING TEST FAILURES

- A. General: Immediately upon determination of a test failure, the Owner's inspector shall telephone the test results to the Owner's Representative and Contractor. By the end of the following day, the Owner's inspector shall send written test results to those named on the distribution list.
- B. Contractor shall similarly report test failures to Owner's Representative resulting from work of testing agencies provided by the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Minimum temporary facilities and controls requirements are specified in this Section. Nothing in this Section is intended to limit types and amounts of necessary temporary facilities required to perform the Work, and no omission from this Section will be recognized as an indication that a necessary temporary facility is not required for successful completion of the Project, and compliance with the requirements of the Contract Documents and all applicable codes.
- B. Included in this Section are the following headings:
 - 1. Product Delivery, Storage, and Handling
 - 2. Project Site - Work Area
 - 3. Protection of Existing Utilities
 - 4. Shutdowns of Existing Equipment and Utility Services
 - 5. Temporary Support Facilities
 - 6. Temporary Enclosures and Miscellaneous Construction
 - 7. Noise and Vibration Control
 - 8. Construction Parking and Staging
 - 9. Construction Traffic
- C. Behavior:
 - 1. The Owner will not tolerate inappropriate behavior by any worker on a jobsite toward a student, staff, patient, visitor, neighbor or employee.
 - 2. The Contractor shall not allow obscene, offensive or otherwise inappropriate material to be displayed at the Project site, or at remote construction staging or parking areas, including job offices and trailers. If such material is displayed, it shall be immediately removed by the Contractor and/or when requested by the Owner's Representative.
 - 3. Gratuities to Owner's employees by a Contractor are not allowed per Washington Administrative Code, Chapter 42.52 RCW.
- D. Conservation: The Contractor shall install and operate temporary facilities and perform construction activities in a manner which reasonably will be conservative and avoids waste of energy and materials, including water.
- E. Pest Control: The Contractor shall rid the Project site of rodents, birds, insects, and other pests which may have entered buildings under construction as a result of the work.
- F. Pollution Control: The Contractor shall perform the Work so as to prevent water, soil, and air pollution.
 - 1. The Contractor shall not discharge volatile, harmful, or dangerous materials into the Owner's sanitary sewer and storm water drainage systems.
 - a. Non-storm water discharge into the Owner's storm water system is prohibited, including the following type of discharge, unless the stated conditions are met:
 - (1) Discharges of potable water for, but not limited to, water line flushing, hyper-chlorinated water line flushing, fire hydrant system flushing, and

hydrostatic test water must be de-chlorinated to a concentration of 0.1 parts per million or less, pH-adjusted if necessary, and volumetrically and velocity controlled to prevent re-suspension of sediments in the storm water system.

- b. Street sweeping must be performed prior to washing the street at construction sites.
 - c. All discharges into the sanitary sewer require Owner's prior approval.
- 2. The Contractor shall not cause or allow visible emissions of fugitive dust from the construction site, unless reasonable precautions are employed to minimize the emissions. Reasonable precautions include, but are not limited to, the following:
 - a. During high winds, the use of control equipment and/or enclosures, the reduction of construction vehicle speeds, and the curtailment of all dust creating construction procedures shall be implemented.
 - b. When demolition, excavation, and construction activities generate dust, the construction site shall be sprinkled with water or chemical stabilizers to minimize dispersion.
 - c. Truck under-carriages shall be brushed to minimize the transporting of dirt off construction sites.
 - d. Truckloads shall be covered, wetted, or allowed adequate freeboard to prevent the escape of dust-bearing materials.
- G. Silica Dust Control: The Contractor shall use best engineering and work practice controls to reduce exposure to silica dust at or below the Washington State Permissible Exposure Limit defined in the latest regulations from the Washington State Department of Labor and Industries (L&I), Puget Sound Clean Air Agency (PSCAA) and any other applicable federal, state, and local government regulations.
 - 1. The Contractor shall assume that silica is present in all concrete, mortar, terrazzo flooring, plaster, sheetrock, fireproofing and other related building products.
 - 2. The Contractor shall implement controls to contain and clean-up silica dust generated by cutting and demolition work and shall provide worker and equipment decontamination provisions. At no time is silica dust from the construction permitted beyond the "work area."
 - a. The Contractor shall conduct air sampling for respirable crystalline silica in accordance with the National Institute for Occupational Safety and Health (NIOSH) method 7500.
 - b. The Contractor shall comply with OSHA 29 CFR Part 1926.134, WAC 296-62-071 (Respiratory Protection) and ANSI Standard Z88.2-1990 "Practices for Respiratory Protection."

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle specified products in accordance with the manufacturer's recommendations and use means and methods that will prevent damage, including, but not limited to, moisture damage of materials, deterioration, and loss or theft.
 - 1. Store materials and products off the ground and protect from weather.
- B. Furnish products in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- C. Include a waste reduction provision in purchasing agreements requiring that materials and equipment be delivered in packaging made of recyclable material, that the amount of packaging be minimized, and that packaging be taken back for reuse or recycling.
 - 1. The Contractor shall require the same provisions in its Subcontractor's purchasing agreements.
- D. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are dry and mold free, undamaged, and properly protected.
- E. Store products at the Project site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- F. Store heavy products away from the Project structure in a manner that will not endanger the supporting construction.
- G. Protect building products subject to damage, under cover in a clean and weather-tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions. **Although the Contractor is responsible for protection of building products, the actual cost shall be included in Divisions 02 through 49 subcontract bid packages.**
- H. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 - 1. Ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

1.3 PROJECT SITE - WORK AREA

- A. Construction Photographs: Photograph the Project site prior to the start of construction to document original site conditions and provide digital copies of the photographs to Owner. The photographs will be used for determination of the extent of restoration required.
- B. Confine operations, equipment, and storage to the designated work area.
 - 1. Maintain the Project site, including adjacent areas and properties, in a clean and orderly manner free from accumulations of combustible materials and construction waste, including rubbish and debris resulting from construction operations. Clean indoor work areas daily of construction waste, dirt, and dust. Do not store construction materials and equipment in Owner-occupied areas unless approved by the Owner. Immediately clean up any spilled material and/or fugitive construction spoils or debris from adjacent properties and vehicle travel ways. Keep streets, fire lanes, and walks clean and free from obstructions.

2. Mechanical rooms shall not be used for construction storage, unless otherwise approved by Owner.
 3. All masonry cutting shall be done outdoors. Cut stations for all other work shall be located outdoors or within well ventilated dustproof enclosures or other approved containment.
- C. Security:
1. General:
 - a. Protect work and stored products from theft and vandalism and protect premises from entry by unauthorized persons. At the end of workday, close temporary enclosures and lock exterior doors and/or gate. Secure all openings at any time the Project site is left unoccupied.
 - b. Owner's Keys: Owner's Representative will issue keys, as required, for the Contractor to perform the Work. Prior to Substantial Completion, the Contractor will return all issued keys. Contractor's responsibility shall include, but not be limited to, the following:
 - (1) Arrange for the issuance of access keys on a daily basis, or as mutually agreed with Owner.
 - (a) Owner's costs associated with re-keying a system due to lost keys will be the responsibility of the Contractor.
 - (2) Lock all access doors when not attended and at the end of each shift.
 - (3) Provide security barriers, acceptable to Owner, at all utility openings which are created by the removal of gratings.
 - (4) Coordinate Work to minimize need for access to restricted areas.
 - c. Contractor is advised to lock its gang boxes and secure them. Owner will not reimburse Contractor for any lost or stolen tools, material, or equipment.
- D. Construction Waste: Provide on-site containers for the collection and recycling of construction waste and recycling materials. Remove collected materials from the Project site at a frequency acceptable to the Owner and dispose of in a lawful manner. Do not burn waste material, stockpile waste material, or bury waste material on Owner's property. Do not use Owner's waste containers for construction waste of any kind, unless approved by Owner. Dispose of all refuse and waste material, including excess earth from excavation, off of Owner's property. Coordinate on-site container locations with Owner's Representative. **Although the Contractor is responsible for "construction waste," the actual cost shall be included in Divisions 02 through 49 subcontract bid packages.**
1. See Section 01 74 00 "Construction Waste Management" and, when specified, Section 01 11 01 "Summary of Work – Regulated Materials" for additional requirements.
- E. Odor Control:

1. General: Adjacent Owner areas and/or neighboring buildings may be occupied during construction. The use of solvents and materials producing noxious fumes or any product or equipment that adversely impacts air quality shall be subject to the approval of Owner. Isolate odor-causing work away from building air intakes, private properties and pedestrian traffic areas. Where solvents are used within enclosed structures, vent to outside areas.
 2. Emissions Control Plan: The Contractor shall submit a written procedure for control of emissions prior to any use.
 - a. The plan shall at a minimum consist of the following items:
 - (1) Products to be used/Material Safety Data Sheets
 - (2) Location of Work
 - (3) Application
 - (4) Ventilation plan
 - (5) Hours of operation
 - (6) Materials handling/storage
 - b. Considerations shall include, but are not limited to:
 - (1) Concrete curing
 - (2) Roofing and waterproofing
 - (3) Welding
 - (4) Exterior painting
 - (5) Adhesive and/or stripping and paint removal
 - (6) Asbestos abatement
 - (7) Soil remediation
 3. Equipment and trucks producing fumes shall not be parked or located in the vicinity of building air intakes, entrances, and operable windows, unless approved by the Owner.
 - a. Trucks that are idling for more than a few minutes shall shut off their engines. If trucks are queued and idling, there must be at least 20 feet between each truck or the exhaust shall be piped to have a 20-foot separation between each exhaust.
 - b. All diesel-powered construction equipment shall utilize ultra-low sulfur diesel fuel.
 - c. All diesel-powered construction equipment and trucks must be: 2007 model year or later (for vehicles); or Tier II heavy duty (for stationary engines); or equipped with 3-CARB verified oxidation catalyst-based particulate emissions control devices, operating at 600 degrees F or above.
- F. Smoking: The Owner has restricted smoking policies. The Contractor shall not permit its employees or the employees of its Subcontractors of any tier to smoke on the Owner's property, except in the areas indicated below:
1. If the Project site includes a fenced construction area, the Contractor shall establish an outside area, within the fenced area, where its employees and the employees of its Subcontractors may smoke, provided that the area is in compliance with the requirements of Chapter 70.160 RCW. The Contractor shall communicate the location of the permitted smoking area to its employees and Subcontractors, and shall require

Subcontractors (of any tier) to communicate the location of the smoking area to its employees.

1.4 PROTECTION OF EXISTING UTILITIES

- A. The existing concealed utilities shown on the Drawings are not necessarily exact with respect to location or completeness. Therefore, the Contractor shall take the following steps:
 - 1. Notify Owner in writing, with a minimum two (2) week notice for each occasion, of the intent to work near existing known underground utility services or structures or when a new excavation operation is about to begin. Submit procedure for approval to assure safe and continuous operation of the services.
 - 2. Proceed with sufficient caution to preclude damaging any known utilities (i.e., hand digging or probing). In the event unidentified utilities are encountered, notify Owner's Representative immediately.
 - 3. In the event utilities are damaged during construction, temporary services and/or repairs must be made immediately to maintain continuity of services.
 - a. Utilities installed by the Contractor, and damaged by the Contractor, shall be repaired at the Contractor's sole expense.

1.5 SHUTDOWNS OF EXISTING EQUIPMENT AND UTILITY SERVICES

- A. It is generally critical that all building systems remain operational within occupied buildings, except for brief shutdowns that might be required to integrate or connect new Work. Similarly, continuity of equipment and utility services to adjacent buildings and Owner's infrastructure shall also be reasonably maintained at all times.
- B. Equipment or utility shutdowns required to facilitate the Work shall be accomplished in accordance with the following requirements:
 - 1. Submit a schedule of equipment and utility shutdowns (see Section 01 32 16 "Construction Progress Schedule").
 - 2. Submit a Utility Shutdown Request to schedule all equipment and utility shutdowns not less than fourteen (14) days prior to the proposed date. Include, as a minimum, the following information:
 - a. Equipment or utility services affected
 - b. Reason shutdown is required
 - c. Work to be accomplished during the shutdown
 - d. Proposed date and time
 - e. Duration of the shutdown
 - f. Proposed method of providing back-up service during shut down
 - 3. The actual time and date of all shutdowns will be subject to approval of Owner. Shutdowns normally will be scheduled for nights or other low intensity use periods.
 - 4. The duration of all shutdowns shall be held to a reasonable minimum as determined by Owner.

5. Materials and equipment required for the Work to be accomplished during shutdown shall be complete and available on the job for review by Owner three days prior to the shutdown, if requested. If Contractor is not adequately prepared, the shutdown will be canceled and rescheduled.
 6. ONLY OWNER'S PERSONNEL WILL SHUT DOWN AND RESTART OWNER'S EQUIPMENT AND UTILITIES. Owner will inspect the installation prior to restarting and will not restart if an unsafe condition exists. In the event Contractor's Work is not completed during the time scheduled for the shutdown, Owner may elect to restart the equipment or utility service. In that event, additional shutdown requirements shall be rescheduled in accordance with the preceding requirements. Restarting shall not be construed as acceptance of the Work as complete.
 7. Include in the bid all costs associated with equipment and utility shutdowns. Owner will make no extra payment for overtime work, schedule changes or failure to complete utility connections within authorized shutdown periods. **Although the Contractor is responsible for shutdowns, the actual cost shall be included in Divisions 02 through 49 subcontract bid packages.**
- C. For building electrical shutdowns involving de-energization of equipment on the campus high-voltage distribution system, including main breakers for a given building, the following enhancements to the requirements listed above apply. The Owner's Representative will determine which shutdowns proposed by the Contractor require such enhancement.
1. A minimum of 4 weeks before the proposed shutdown, the Contractor shall submit a Proposed Shutdown Plan to the Owner's Representative. This Shutdown Plan shall include the following information:
 - a. A description of Contractor tasks and safety measures (such as lock-out/tag-out), necessary to install or otherwise create the project improvements. Include specific names of devices to be switched and a complete list of equipment to be de-energized.
 - b. Inspections by the engineer of record, and/or the authority having jurisdiction, as applicable. Indicate what inspections are requested and where in the sequence of work they occur.
 - c. Proposed dates(s) and time(s) with duration(s) of the shutdown. Alternate dates may be proposed but the earliest of the proposed dates shall be no sooner than 4 weeks from the date of submittal of the Shutdown Plan.
 2. If the Proposed Shutdown Plan is approved or approved with conditions, proceed as follows in paragraph 5. If rejected, work with the Owner's Representative to reschedule the shutdown.
 3. A minimum of 2 weeks before the proposed shutdown, review status with the Owner's Representative and submit the final UTILITY SHUTDOWN REQUEST. If deemed necessary by the Owner's Representative, also submit a final Shutdown Plan. These documents shall include, at a minimum, the following information:
 - a. The final proposed date, time and duration of the shutdown.
 - b. Responses to any conditions imposed on the shutdown by the Owner's review and approval process.
 - c. Any Contractor-proposed changes to the original (draft) plan.

1.6 TEMPORARY SUPPORT FACILITIES

- A. Temporary support facilities include: construction power and lighting and heating and water, toilet and hand washing facilities, mobile communications, cranes and hoists, field offices, and field office communications; and similar miscellaneous facilities (i.e., storage sheds, first aid facilities, clean-up facilities, fire protection, waste disposal) as may be reasonably required for proficient performance of the Work and accommodation of personnel at the Project site, including Owner's and A/E's personnel. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities. Placement of all temporary support facilities shall be subject to review and approval by the Owner's Representative.
1. Do not block Owner's access to adjacent buildings and occupied spaces through the use of temporary support facilities.
 2. Keep temporary support facilities clean and neat in appearance and do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload temporary facilities or permit them to interfere with construction progress.
- B. Remove all temporary support facilities including, but not limited to, hoist power and water infrastructure, hoist foundations, and communications cabling and pathway; unless indicated otherwise in the Contract Documents. Restore the Project site to original or new conditions, patching and filling as required to match adjacent surfaces. **Although the Contractor is responsible for the removal of temporary support facilities, the actual cost shall be included Divisions 02 through 49 subcontract bid packages.**
- C. All connections to Owner utilities must be made in accordance with 1.5 of this Section, "Shutdowns of Existing Equipment and Utility Services."
1. Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of the permanent service.
- D. Electrical Power and Service: Coordinate the need and pay for all electrical power and service with the local public utility. Contractor shall pay for, provide, and install all necessary temporary equipment for the installation and removal of construction power as required for the Project and by the Owner and/or public utility. Temporary equipment shall be installed and maintained in accordance with applicable safety regulations and the Owner's requirements. **Although the Contractor is responsible for electrical service, the actual cost shall be included in Divisions 02 through 49 subcontract bid packages.**
1. Electrical power for the operation of small tools and equipment required for work outside the Project site will be provided by the Owner as reasonably available from approved existing sources.
- E. Lighting: Contractor shall provide and maintain a light system which provides equal to or greater than the minimum illumination requirements of WAC 296-800-21005, see <http://app.leg.wa.gov/wac/default.aspx?cite=296-800-21005>

Contractor shall provide and submit a coordinated temporary lighting plan for Owner review and acceptance that is to be submitted for Owner review and acceptance no less than 14

days prior to the Notice To Proceed. This plan shall include detailed planning, layout and phasing that is integrated with job logistical plan and coordinated with the Contractor's Site Specific Safety Plan. **Although the Contractor is responsible for lighting, the actual cost of lighting shall be included in Divisions 02 through 49 bid packages.**

- F. Heating and Ventilation: Provide temporary heat as required to protect materials and equipment from dampness, cold, and mold growth. Method of heating is subject to approval of Owner's Representative. Fuel fired "salamander type" heaters are not permitted, unless approved by Owner.
1. New building HVAC systems shall not be operated or used for construction until such time the Contractor has submitted the Contractor's final punch list report, unless otherwise approved by Owner.
 2. Renovations of Owner's facilities may utilize existing ducted ventilation supply diffusers but shall not utilize exhaust systems, including return-air grills or fans. Un-ducted plenums over a construction work area must have all ceiling tiles in place, unless otherwise indicated in the Contract Documents or approved by the Owner.
 - a. If Owner's HVAC system is utilized for construction, the Contractor shall:
 - (1) Protect the HVAC system from construction dust contamination and provide cleaning of the components exposed to contamination prior to Owner's occupancy.
 - (2) Install filter media having a minimum efficiency reporting value rating of 8 (MERV 8) according to the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 52.2-1999 at each supply and return-air grill used during construction.
 - (3) Replace Owner's filtration on any return air fan system with a minimum 85% filtration media (as determined by ASHRAE 52.1-1992) prior to Substantial Completion.
 - (4) **Although the Contractor is responsible for items 1.6F3.a. (2) and (3), the actual cost shall be included in the Divisions 02 through 49 bid packages.**
- G. Water: Contractor shall coordinate and pay for: all temporary construction water with the local public utility; all cost of temporary piping including pressure reducing station, back flow preventer; and removal of piping and restoration as required by the public utility at the completion of the Work. **Although the Contractor is responsible for construction water, the actual cost shall be included in Divisions 02 through 49 subcontract bid packages.**
1. Contractor shall provide drinking water from a proven safe source for all those connected with the Work.
 - a. The Owner's potable water drinking facilities may be used, if available and approved by Owner.
- H. Toilet and Hand Washing Facilities: Contractor shall provide self-contained properly ventilated single-occupant toilet units of the chemical or aerated circulation type that are fully enclosed with a glass fiber reinforced polyester shell, or similar nonabsorbent material, and portable hand washing facilities.

- a. The Owner's toilet facilities may be used if available and provided they remain in a clean condition, as approved by Owner.
2. Provide alcohol hand sanitizers or hand gel dispensers for workers in medical centers if restrooms and/or similar hand washing facilities are not available within the Project site.
- I. Mobile Communications: The Contractor shall provide cellular phones with e-mail capability for key on-site personnel.
- J. Crane(s) and Hoisting: Provide crane(s) and hoisting equipment including, but not limited to, mobile and/or tower cranes, personnel hoists, forklifts, and other specialized lifting apparatus, as required for the work.
 1. Electric or bottled gas forklifts shall be used whenever possible for the Work.
- K. Contractor's Field Office: Contractor is to provide and pay all costs for installation, removal, and site restoration of temporary field office space within the Project site for use by Contractor's personnel. The field office shall remain on-site until all punch list work is complete, unless otherwise approved by Owner.

1.7 TEMPORARY ENCLOSURES AND MISCELLANEOUS CONSTRUCTION

- A. Temporary enclosures include, but not by way of limitation, fire-rated barriers, dustproof enclosures, and site fences to protect the Work and to provide for public protection as required by law and ordinance. **Although the Contractor is responsible for temporary enclosures the, the actual cost shall be included in Divisions 02 through 49 bid packages.**
 1. Provide one-hour fire-rated barriers of gypsum sheetrock and metal studs with taped joints where shown on the Drawings or when removing and/or compromising existing fire safety partitions indicated on the Drawings, such as corridor wall and/or occupancy separations, to completely isolate the construction area from other occupied building areas. Remove and repair finishes to match existing at completion of Work.
 - a. Fire Safety during construction, alteration, or demolition must be provided as indicated by the current edition of the International Fire Code with local amendments and applicable rules. Combustible materials are not permitted to be used as barriers.
 2. Provide dustproof enclosures within occupied buildings to enclose entire work area and completely isolate it from surrounding areas, unless otherwise approved by Owner. At a minimum, construct dustproof enclosures on metal studs from one layer of: 5/8 inch gypsum sheetrock; 1/4 inch fire retardant low VOC (volatile organic compounds) shiny surface materials (such as melamine); 6-mil fire retardant plastic sheathing; or 4-mil fire retardant polypropylene. Tape all joints smoke tight and continuously seal all connection points to existing construction utilizing painters tape for existing surfaces to be retained, melamine tape for melamine enclosures, and duct tape for existing surfaces not to be retained. Enclosures must extend above ceilings to the structure above except when the entire work area ceiling is completely sealed from the above ceiling space, in which case, the seal may occur at the ceiling. If the Contractor employs a combination of temporary enclosures and existing construction to enclose the work area, the Contractor shall seal any penetrations found in the existing construction, including supply and exhaust HVAC duct grills that must be blocked off and sealed shut.

- a. All existing finishes damaged by construction are to be repaired to their original condition and ceiling tiles damaged by Contractor shall be replaced with equivalent undamaged tiles at the completion of the Work.
3. Fire barrier and/or dustproof enclosure doors are to be installed in rigid frames and be self-closing and fitted with a gasket or other material to restrict closing noise and inhibit airflow, except for plastic sheathing enclosures which shall have zipper wall doors for personnel access. The door and its frame shall be painted in medical centers.
 - a. All interior Project site work entrances and exits must have dust containment walk-off mats (sticky mats) present at all times. Provide 24" x 36" minimum size with layers to be peeled off when fully loaded. Secure mats to floor and install snug to enclosure entrances.
 - (1) Mats must be clean, intact, and maintained on a constant basis. Avoid locating mats in public walking areas and patient transport areas in medical centers.
5. Site Fences: Provide temporary six (6) foot high chain link fence panels with top rail fastened to tubular metal posts set in heavy concrete bases to prevent ready relocation, unless otherwise indicated, to enclose exterior areas of the Project site and off-site lay-down and Contractor parking areas provided by the Owner. Panels are to be anchored together to prevent entry between panels. Provide gates or equal to facilitate access to fire hydrants, pumper connections and standpipes. No barbwire is permitted.
- B. Provide miscellaneous construction to protect the Work. Furnish, install, and maintain for the duration of construction all required tarpaulins, barricades, security barriers, canopies, warning signs, steps, bridges, platforms and other temporary construction necessary for the safe and proper completion of the Work. Maintain the temporary construction in compliance with all pertinent safety and other regulations. Temporary barricades that obstruct exit paths from occupied areas shall not be installed unless approved by Owner.
 2. Egress Signage: Provide and install temporary exit signs, as needed, to insure a clear direction or emergency exit travel in occupied areas adjacent to the construction project. Review the temporary exiting routes and signage design and location with Owner's Representative.
 3. Other Signage: Provide informational signs, warning signs, and any other sign required by AHJ for the Project.

1.8 NOISE AND VIBRATION CONTROL

- A. Construction shall not exceed the maximum permissible sound levels defined by the local AHJ and shall meet the special conditions of the Project.
- B. Construction Noise: Maintain the sound pressure level of exterior construction noise from exceeding 60 decibels with a frequency rating function A (60 dBA) inside adjacent facilities with windows closed between the hours of 6:00 a.m. and 7:00 p.m. weekdays.
 1. If required, the Contractor shall meet this criterion by erecting barriers between work equipment and adjacent facilities.

- D. Noise and Vibration Control Plan: Contractor shall submit a written procedure to minimize construction vibration and noise prior to performing physical impacts to, or demolitions of, existing structural components.
- E. Machinery & Equipment: Equipment shall be as quiet as feasible for the work being performed. Electric-driven or hydraulically drawn is preferred to gas, diesel, or pneumatic powered machinery. If noise levels on any gear cannot reasonably meet the criteria of this Section, either that gear will not be allowed on the job, or use times will have to be scheduled subject to approval of the Owner. Conformance to this requirement shall be included in the Contract price and no compensation will be allowed for special equipment or overtime that may be required.
 - 1. Construction personnel shall limit the extent of unnecessary equipment idling.
- F. Outdoor Vehicle and Internal Combustion Engine Noise: In addition to the requirements applicable to exterior construction noise in this Section, the sound pressure level of each piece of equipment shall not be greater than 85 dBA when measured at the property line of adjacent real property of another person, and when measured at a distance of 50 feet from the emission source as under noisiest operating conditions. **Although the Contractor is responsible for construction vehicle noise, the actual cost for the requirements of this item shall be included in Divisions 02 through 49 subcontract bid packages.**
 - 1. Rubber-tired equipment is to be used whenever possible instead of equipment with metal tracks.
 - 2. When required, mufflers for stationary engines shall be "hospital-area" quality of silencing.
 - a. Contractor is to routinely verify equipment mufflers and/or noise barriers are intact and operational.
- G. Air Compressors: Equip air compressors with silencing packages--electric-driven preferred.
- H. Arc Welders: No arc welders are to be connected to Owner's utilities, unless approved by the Owner. Provide separate gas generators for arc welders.
- I. Jack Hammers and Rotary Hammer Drills: May be used where no other alternative is available, if permitted by the Owner. The use of core-drilling or saw cutting equipment or electric driven drills is preferred. Time of use is subject to approval by Owner.

1.9 CONSTRUCTION PARKING AND STAGING:

- A. Parking shall be coordinated with the Owner.
 - 1. Limited off-street parking will be available for Contractor and sub-contractor use. Exact location to be coordinated with the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015639 – TEMPORARY TREE PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies minimum requirements for protection from damage as a result of the Contractor's operations and for maintenance of existing trees, shrubs, and other plant materials including lawn surfaces indicated to remain on the Project site.
- B. The Contractor shall ensure all labor, equipment, and materials are provided for temporary tree, plant, and lawn protection during the work including, but not limited to:
 - 1. Marking of clearing limits;
 - 2. Protection signage and fencing;
 - 3. Tree trunk boxing;
 - 4. Tree and root pruning; and
 - 5. Maintenance of trees and landscaping.
- C. Definitions:
 - 1. Landscape Requiring Protection and Maintenance: All existing on-site trees, plants, and lawn areas which are not identified for removal or for Contractor's lay down or parking use, including tree canopies and root zones extending within the Project site.
 - 2. Critical Root Zone (CRZ): The area around a tree equal to one (1) foot radius for every inch of tree diameter measured at four (4) feet above grade.
 - 3. Certified Arborist: An arborist certified by the International Society of Arboriculture (ISA).
 - 4. Dripline: The dripline of a tree is the imaginary line on the ground beneath the tree's canopy.
- D. **Although the Contractor is responsible for temporary tree and plant protection, the actual cost shall be included in the Division 02 through 49 subcontract bid packages.**

1.2 SUBMITTALS

- A. Tree and Landscape Protection Plan: Prior to any site disturbance, the Contractor shall submit for Owner's approval a "Tree and Landscape Protection Plan" developed in consultation with a certified arborist for all trees, plants, and lawn indicated to remain. The Contractor shall submit the name and credentials of the certified arborist with the plan.
 - 1. The Tree and Landscape Protection Plan shall include:
 - a. Proposed protection fence locations;
 - b. The location of all on-site trees requiring protection;
 - c. Identification of the CRZ for each tree requiring protection; and
 - d. Temporary irrigation and fertilization schedule.

1.3 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall assume all landscape shall be protected, unless indicated to be removed in the Contract Documents, and shall be responsible for all damage and/or

disturbance within the CRZ of trees indicated to remain such as, cutting or skinning of roots, skinning or bruising of bark, compaction of root zones, and breaking of branches.

1. Damage and/or disturbance which, at the Owner's sole discretion, can be remedied by corrective maintenance shall be immediately repaired by the Contractor upon written notice by Owner.
 - a. The Contractor shall employ a certified arborist to repair damage to trees.
2. Trees or shrubs which are injured or irreparably damaged shall, at the Owner's sole discretion, be replaced by the Contractor with new trees or shrubs of the same size and type. However, the Owner is not bound to have the trees or shrubs replaced in the same location and may request the Contractor provide the tree or shrub for installation by Owner.
 - a. Trees which fail to fully foliate in the spring following Substantial Completion shall be presumed to have been injured or irreparably damaged due to construction.
3. If, in the Owner's sole opinion, replacement of damaged trees is determined impracticable, the full replacement cost shall be borne by the Contractor at values based upon the square inches of cross-sectional area of trunk measured at four (4) ft. above grade, in accordance with the following criteria:
 - a. \$75.00/square inch for trees less than or equal to six (6) inch diameter
 - b. \$50.00/square inch for trees greater than six (6) inch and less than eighteen (18) inch diameter
 - c. \$40.00/square inch for trees greater than or equal to eighteen (18) inch diameter
- B. Trees or shrubs which require removal and/or replacement due to damage by construction shall be removed to a depth of two (2) feet below grade and include the refilling and repair of the ground surface, with such costs to be borne by the Contractor.
- C. Protection and maintenance shall include, but not be limited to, replacement of damaged protection fencing; aeration of compacted soils; control of temporary irrigation water runoff; pruning and treatment of damaged roots, limbs, and branches; and replacement of wood chips within tree protection areas.
- D. Site damage and/or disturbance caused by the Contractor outside the Project site shall be repaired or replaced, and all costs shall be borne by the Contractor.
 1. Repairs shall include, but are not limited to, pruning, or removing damaged vegetation, replacement of damaged vegetation and/or lawn restoration, soil remediation to alleviate over-compaction, and temporary irrigation to establish new plantings.

PART 2 - PRODUCTS

2.1 PROTECTION FENCING

- A. Protection fencing shall be six (6) feet high, 11 gauge-galvanized, 2-inch mesh chain link fencing with nominal 2 1/2-inch diameter galvanized steel posts, or approved equal.
 1. The Contractor shall post weather-resistant 8 1/2" x 11" fluorescent green or yellow signage on protection fencing at twenty (20) foot intervals warning construction personnel to keep out of protective zones.

2.2 TREE TRUNK BOXING

- A. Existing trees that are not protected with fencing and are to remain shall be protected by boxing constructed with 4 x 4 inch posts at corners with 2 x 4 inch horizontal top, middle, and bottom rails on each side. Box shall be approximately 8 x 8 feet in size centered on the tree trunk to a height of approximately six (6) feet.

2.3 WOOD CHIPS

- A. Wood chips shall be composted for a minimum of one (1) year prior to use.

2.4 FERTILIZER

- A. Fertilizer shall be Osmocote Plus 15-9-12, or approved equal.

PART 3 - EXECUTION

3.1 ON-SITE PRE-INSTALLATION MEETING

- A. Prior to on-site mobilization, the Contractor shall arrange a pre-installation meeting with the Owner's Representative to identify and stake out all areas of trees, plants, and lawn that are to be protected or removed. The Contractor shall be responsible for all damage to landscape features that results from the failure to schedule and attend the pre-installation meeting.

3.2 PROTECTION OF EXISTING TREES AND SHRUBS

- A. Trees indicated to remain within the Project site shall have protection fencing located at the CRZ drip line that shall be maintained by the Contractor in good condition until Substantial Completion. Tree trunk boxing may be permitted by approval of Owner.
- B. When no ground cover, lawn or shrubs exist within the CRZ of a tree indicated for protection, the ground shall be protected with a minimum of twelve (12) inches of wood chips extending from a three (3) foot radius clear zone around each truck to the protection fencing.
- C. All site work within the CRZ shall be performed by hand. However, the use of heavy equipment to perform work within the CRZ may be requested by the Contractor for approval by the Owner. The Contractor shall perform approved heavy equipment work from angles and directions that minimize compaction to tree roots in the protection area.
- D. The Contractor shall utilize a certified arborist to tie back all flexible limbs and overhead branches which may be damaged by the passage or activity of construction equipment.
- E. Materials shall not be stored and equipment shall not be operated under the branches of existing trees which are to remain, except as approved by the Owner.

3.3 INSTALLATION OF TREE PROTECTION FENCING

- A. Install posts a minimum of two (2) feet below grade and spaced ten (10) feet on center maximum. Provide diagonal bracing to posts at corners of enclosures and whenever needed to ensure rigidity of the fencing.
- B. Install fencing tight to grade at the bottom edge and stretched uniformly between posts.
- C. Provide one gate into each fenced area.
- D. Take care not to damage roots or to compact soil inside the fence line during placement of posts. Do not use heavy equipment within the protection area for this operation.

3.4 USE OF AREA ADJACENT TO PROTECTION FENCING

- A. Do not store materials potentially harmful to tree roots within twenty (20) feet of protection fencing. Potentially harmful materials include, but are not limited to, petroleum products, cement and concrete materials, cement additives, lime, paints and coatings, waterproofing products, concrete forms coatings, detergents, acids, and cleaning agents.

3.5 FERTILIZING AND IRRIGATING DURING CONSTRUCTION

- A. All trees and landscape requiring protection shall be fertilized and watered by the Contractor until Substantial Completion, per the approved Tree and Landscape Protection Plan.
 - 1. Water used for irrigation shall be potable water.

3.6 ROOT PRUNING

- A. Root pruning is the intentional cutting of tree roots to minimize root damage and promote healing. (Any construction operation which pulls and/or tears roots is unacceptable.)
 - 1. All root pruning shall be performed by a certified arborist.
 - 2. For all roots smaller than one (1) inch diameter, use a sharpened spade.
 - 3. For all roots greater than one inch (1) diameter, use an ax or chainsaw.
 - 4. A backhoe bucket, or any other excavating machine, should not be used to root prune.
- B. When construction is in close proximity to existing trees to remain, and roots are encountered, the roots shall be pruned.
 - 1. Root pruning shall be performed as early as possible before trenching or tunneling operations.
 - a. Hand-dig trenches in areas with extensive roots.
 - 2. Leave roots larger than two (2) inches in diameter intact and undamaged.
 - a. Keep roots moist with wet mulch and burlap or equivalent during exposure.
- C. Backfill trenches that require root pruning with existing soil mixed with peat moss to a mixture of approximately 75% loam and 25% humus by volume. Tamp soil in six-inch lifts. Each lift shall be compacted to a point at which a footprint makes only a 1/16 inch impression.
- D. Apply mulch to a depth of four (4) inches at a minimum ten (10) to fifteen (15) foot radius around tree to reduce compaction and increase moisture retention.

3.7 PRUNING OF EXISTING TREES

- A. Limbs and branches broken by construction shall be cut off cleanly above the nearest crotch in accordance with good horticultural practice.

END OF SECTION

SECTION 015713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Erosion and Sediment Control Measures.

1.02 RELATED SECTIONS

- A. Section 015700 – Temporary Controls

1.03 REFERENCES

- A. Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction (current edition).

1.04 SUBMITTALS

- A. Hydroseed mix.
B. Catch Basin Insert product data..

1.05 QUALITY ASSURANCE

- A. The owner shall provide weekly inspections of the installed erosion control measures to ensure they're functioning properly. The contractor shall repair any deficiencies within 24 hours of being made aware by the Owner.

PART 2 PRODUCTS

2.01 TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

- A. Silt Fence: Silt fences shall conform to the details shown on the Drawings and the fabric shall conform to the WSDOT Standard Specifications Section 9-33.2, table 6.
B. Storm Drain Inlet (Catch Basin) Protection: Storm drain inlet protection shall conform to the details shown on the Drawings. Geotextile fabric shall meet the requirements of the WSDOT Standard Specifications Table 1 for moderate survivability, and the minimum filtration properties of Table 2, in Section 9-33.2.
C. Construction Entrance: The construction entrance shall consist of quarry spalls that conform to the WSDOT Standard Specifications Section 9-13.6.
D. Hydroseed:

SEED MIX			
	% Weight	%Purity	%Germination
Perennial rye blend <i>Lolium perenne</i>	70	98	90
Chewings and red fescue blend <i>Festuca rubra</i> var. <i>commutata</i> or <i>Festuca rubra</i>	30	98	90

1. Mulch is required at application rate of 1,500 pounds per acre with 3 percent tackifier.
2. Mulch shall be made up of 100%: cottonseed meal; fibers made of wood, recycled cellulose, hemp, and kenaf; compost; or blends of these.
3. Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.
4. Fertilizer shall be organic matter in the least water-soluble form is preferred. 10-4-6 N-P-K (Nitrogen-Phosphorus-Potassium) is an acceptable chemical fertilizer, and shall be used at a rate of 90 pounds per acre.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site to confirm location of erosion control measures as shown on the drawings will prevent sediment laden runoff from leaving the site.

3.02 TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES INSTALLATION

- A. Silt Fence: Silt fence shall be installed by trenching in the bottom of the fabric and backfilling as detailed on the plans. Any fence that becomes damaged during the course of construction will require that new silt fence be installed directly above or below the damaged fence. Silt fence shall be installed prior to any clearing and grubbing on-site.
- B. Storm Drain Inlet Protection: Install catch basin inserts per manufacturer's instructions. Inserts shall be installed where shown on the plans.
- C. Construction Entrance. Remove existing vegetation and topsoil at location of entrance. Place quarry spalls in a 12" thick compacted layer to the dimensions shown on the plan. The construction entrance shall be installed prior to any excavation or hauling of materials to the site.
- E. Hydroseed: Mulch, seed, fertilizer, and tackifier may be applied in one lift. Multiple lifts will also be acceptable. Installer shall follow manufacturer's installation instructions.

3.03 TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES MAINTENANCE

- A. Maintenance required due to improper installation of the silt fence shall be fixed by the contractor at no additional cost to the Owner.
- B. Any labor and equipment required to maintain the functionality of the TESC measures throughout the life of the project shall be the responsibility of the Contractor and included in the bid.

END OF SECTION

SECTION 015800 – PROJECT IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish, install and maintain on-site Project identification signage.
- B. Allow no other corporate or project signage to be displayed, except if approved by Owner

1.2 SUBMITTALS

- A. Design Data: Submit sign construction details. Where text may not be detailed, show layout of required information as directed by Owner. Indicate margins, borders, spacing, and the like.

PART 2 - PRODUCTS

2.1 PROJECT IDENTIFICATION SIGN

- A. One (1) painted sign of the size, graphic design, style of lettering, and construction as indicated or directed by Owner.
 - 1. Colors include the background and two lettering colors.
- B. Sign shall identify Project, Owner, A/E, and Contractor and primary Subcontractors.

2.2 SIGN MATERIALS

- A. Sign Surfaces: Exterior softwood 4 x 8 ft. plywood, 3/4" thickness, with medium density overlay.
- B. Rough Hardware: Galvanized.
- C. Framing and Supports: 4" x 4" construction.
- D. Paint: Exterior quality with "bulletin" colors for graphics. Provide colors for structure, framing, sign surfaces, and graphics, as indicated or directed by Owner.

2.3 FABRICATION

- A. Paint all exposed surfaces with one coat primer and another coat exterior paint as indicated or directed by Owner.
- B. Paint graphics in styles, sizes, and colors, as indicated or directed by Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install identification signage on-site as indicated or at a location of high public visibility as directed by Owner. Locate in lighted location, if possible.

3.2 MAINTENANCE

- A. Maintain identification signage in a neat and clean condition. Repair damages.
- B. Relocate identification signage as required by the progress of the work.

3.3 REMOVAL

- A. Remove project identification signage as a requirement of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies the administrative and procedural requirements for field engineering, in addition to requirements specified elsewhere in the Contract Documents, requiring the Contractor to employ a registered "Structural Engineer" and/or "Land Surveyor."
- B. Related Sections:
 - 1. Section 01 73 29 "Cutting and Patching"

1.2 QUALITY ASSURANCE

- A. Contractor shall employ a registered Structural Engineer (Contractor's Structural Engineer) experienced in construction techniques and sequences, and temporary structural support systems, who is licensed in the State of Washington.
- B. The Contractor shall employ a registered Land Surveyor (Contractor's Surveyor) who is registered in the State of Washington, and acceptable to Owner, to perform survey work of this Section.
- C. Submit the name, address, and telephone numbers of the Contractor's Structural Engineer and Land Surveyor for Owner's records, prior to their performance of Work.

1.3 CONTRACTOR'S STRUCTURAL ENGINEER

- A. The Contractor's Structural Engineer shall advise the Contractor as to the safety and adequacy of all temporary structural provisions necessary for cranes and hoisting, erection and/or alteration of the building structure and shall assume the responsibilities and duties as it relates to means and methods for these items (e.g., erection sequence, temporary bracing, cutting).
 - 1. Temporary bracing shall be coordinated with other trades to permit continuous operation of construction.
 - 2. Should it be necessary to modify the structural design to accommodate construction means and methods, the Structural Engineer shall advise the Contractor who shall immediately notify the A/E and await his/her direction.
 - 3. Proposed changes or modifications to the structural design shall be submitted to the A/E for approval prior to the Contractor incorporating changes or modifications into the Work.

1.4 OWNER'S PROPERTY SURVEY

- A. Owner's property survey for the Project is included in the Contract Documents.
- B. The Owner will provide the services of a public land surveyor to locate the property corners noted on the Contract Documents and establish benchmarks for use by the Contractor.

1.5 PROJECT SURVEY REQUIREMENTS

- A. Before proceeding with layout of actual work, the Contractor, working through the

Contractor's Surveyor, shall verify the layout information shown on Contract Documents and the Owner's property survey.

- B. As work proceeds, the Contractor shall check every major element for line, level and plumb, and shall require the Contractor's Surveyor to maintain a complete and accurate record book log of control of such checks and upon request shall make this log of control available for the Owner's and A/E's reference.
 - 1. Record deviations from required lines and levels and promptly advise the Owner's Representative upon detection of any discrepancies including, but not limited to, conflicts, errors, inconsistencies, or deviations that exceed the Contract specified or indicated or industry recognized tolerances.
 - 2. If discrepancies are found, no work shall be done until the Owner's Representative has been so notified and has provided the Contractor with written direction and/or drawings which correct and clarify the discrepancy.
 - 3. All work which is determined to be incorrectly located will be rejected by the Owner. Any additional corrective work caused by discrepancies that should reasonably have been known to the Contractor and were not called to the attention of the Owner's Representative, shall be borne at the Contractor's expense.
- C. Protect Owner's benchmarks and survey control points prior to starting site work and preserve during construction. Do not change or relocate benchmarks or control points without Owner's written approval. Promptly report lost or destroyed benchmarks or control points.

1.6 PROJECT LAYOUT REQUIREMENTS

- A. The Contractor shall be responsible for laying out the Work utilizing recognized engineering survey practices. Establish elevations, grades, lines and levels for:
 - 1. Site improvements, including pavements, walks and retaining walls, stakes for grading, fill and topsoil placement, utility locations including slopes and invert elevations, and irrigation system.
 - 2. Grid and axis of building structures.
 - 3. Building foundations, column locations, ground floor elevations, elevations and levelness for floors and roofs.
 - 4. Other elevations, grades, lines and levels, as needed to properly locate each element of the Project.
- B. Calculate and measure required dimensions as shown within recognized tolerances. Do not scale drawings to determine dimensions.
- C. Advise entities performing work of marked elevations, grades, lines and levels, provided for their use.

Part 2 - PRODUCTS (Not Used)

Part 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017329 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the administrative and procedural requirements for cutting and patching and general alterations of the Project, including but not limited to, preparations, products, transitions and adjustments, and repairs and disposal.
- B. Related Sections:
 - 1. 01 35 23 "Owner's Safety Requirements"
 - 2. 01 71 23 "Field Engineering"
- C. **Although the Contractor is responsible for ensuring the Work of this section, the actual cost shall be included in the Divisions 02 through 49 subcontract bid packages.**

1.2 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall bear all cost of correcting damaged or destroyed work indicated to remain on the Contract Documents, which is caused from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care by the Contractor and/or the Subcontractors' work.

1.3 SUBMITTALS

- A. Notice:
 - 1. Submit written request two (2) weeks in advance of cutting or alteration which affects:
 - a. Structural integrity of any element of the Project;
 - b. Integrity of weather-exposed or moisture-resistant elements;
 - c. Efficiency, maintenance, or safety of any operational element;
 - d. Visual qualities of sight exposed elements; and
 - e. Work of Owner or separate contractor.
 - 2. Include in request:
 - a. Project Name
 - b. Location and description of affected work
 - c. Description of proposed work
 - d. Reason for cutting or alteration
 - e. Alternatives to cutting and patching
 - f. Effect on work of Owner or separate contractor
 - g. Written permission to affect separate contractor
 - h. Date and time work will be executed, including duration of work
 - i. Utility Shutdown Request form, as appropriate
 - 3. Owner will respond in writing to the submitted request.
- B. Visual Matching: When indicated to "match existing," submit products and/or finishes to match existing adjacent finishes for Owner's review and approval or, for patching new work, use the specified materials and finishes in the Contract Documents.

PART 2 - PRODUCTS

2.1 PATCHING AND EXTENDING WORK

- A. The Contractor shall provide products specified in the Contract Documents and/or match existing products with an alternate product of the most suitable grade for the intended purpose.
- B. The Contractor shall determine the type and quality of existing products and finishes by inspection and/or testing, where necessary.
 - 1. Remove samples of existing installed work for testing only when approved by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencing work:
 - 1. The Contractor shall inspect existing conditions to ascertain elements subject to damage or movement and to determine the need for temporary bracing during cutting and patching work; and
 - 2. Verify that materials to be worked-on or removed have been evaluated in the Owner's Regulated Materials "Good Faith" Survey report.
- B. Beginning of cutting or patching means acceptance of existing conditions.
- C. After cutting and/or removing existing work:
 - 1. The Contractor shall inspect conditions affecting performance of new work and notify Owner of any unforeseen physical conditions; and
 - 2. Verify that demolition is complete and areas are ready for installation of new work.

3.2 PREPARATION

- A. Move, or remove, items as necessary for access to cutting and patching work.
- B. For Owner occupied facilities, prepare a noise and vibration control plan in accordance with Section 01 50 00 "Temporary Facilities and Controls."
- C. Schedule shut-downs and obtain permits required for performance of the Work.
- D. Provide temporary supports to ensure structural integrity of the Work.
- E. Provide temporary enclosures, shielding devices and/or other methods to protect the following from damage:
 - 1. Existing conditions that are to remain
 - 2. Owner-occupied areas
 - 3. Owner's building systems, including HVAC systems
- F. Establish "hot-works" fire safety precautions required for performance of the Work.

3.3 PERFORMANCE

- A. Execute cutting and patching work in a manner to:
 - 1. Avoid damage to other work;
 - 2. Provide proper surfaces for installation of new work; and
 - 3. Provide a neat transition from existing finishes to new work.
 - a. Fit new work to existing pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- B. For new work made to existing work under warranty, employ original installer or fabricator to perform cutting and patching unless otherwise approved by the Owner.
- C. Prepare surfaces to provide for the specified installation of new work and finishes.
 - 1. Remove and replace or repair unsuitable substrate materials (e.g., rotted wood, water damaged materials, corroded metals and deteriorated concrete) for new applications.
- D. Restore existing building systems that are impacted by cutting and patching work to original operating conditions.
- E. For penetrations cut in existing fire-rated separations, completely seal new work with fire-stopping materials to full thickness of the penetrated element.
 - 1. Replace existing fire-stopping materials when disturbed by new work.
- G. Unless otherwise indicated in the Contract Documents, cut concrete and masonry materials using a diamond saw in accurately located straight lines. Pneumatic tools are not allowed without Owner's prior approval.
 - 1. Concrete walls: Core-drill pipe penetrations. Saw both sides of wall and break out remainder. Minimize overcuts.
 - 2. Concrete floors: Provide temporary support of elevated floor areas requiring removal and saw-cut. Core-drill pipe penetrations.
 - 3. Masonry walls: Saw-cut along mortar joints. Remove all mortar adhering to edges. Overcuts are not allowed.
 - 4. Wood and/or metal framed walls: Cut wall finish materials in straight uniform lines and remove wall framing as required.
- H. Remove debris and abandoned items from the work area, including from concealed spaces.

END OF SECTION

SECTION 01 74 00
CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Description of a Job-Site Construction Waste Management Plan
 - 2. Job-Site Waste Reduction Requirements
- B. Related Sections:
 - 1. Section 01 33 00 – Submittal Procedures
 - 2. Section 01 35 15 – LEED Certification Procedures
- C. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.
- D. Job Site Waste Reduction Requirements
 - 1. Divert through salvage, reuse and/or recycle a minimum of 75% of the total construction and demolition material; diverted materials must include at least four material streams OR
 - 2. Do not generate more than 2.5 pounds of construction waste per square foot (12.2 kilograms per square meter) of the building's floor area.
 - 3. To achieve these goals the Contractor shall develop for review a Construction and Demolition Waste Management (CDWM) Plan for this Project in accordance with CDWM Plan requirements under Submittal 1.4.B of this Section
 - 4. Sub-contractors must report all waste and how much was diverted that they take off site that is not controlled through the on-site collection system being monitored by the Contractor's CDWM Plan.
 - 5. Contractor should focus on generating less waste, rather than just diverting waste from the landfill/disposal.
- E. Substitutions: Substitutions will be considered only under the terms and conditions of Section 01 25 00.

1.2 REFERENCES

- A. LEED for New Construction v4 (LEED-NCv4), MR Credit, Construction and Demolition Waste Management.
- B. Waste to Energy: European Commission Waste Framework Directive 2008/98/EC
 - 1. ec.europa.eu/environment/waste/framework/index.htm
 - 2. eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:en:PDF
- C. Waste to Energy: European Commission Waste Incineration Directive 2000/76/EC:
 - 1. europa.eu/legislation_summaries/environment/waste_management/l28072_en.htm
 - 2. central2013.eu/fileadmin/user_upload/Downloads/Document_Centre/OP_Resources/Incineration_Directive_2000_76.pdf
- D. Waste to Energy: European Waste to Heat Standards by Fuel Type:
 - 1. EN 303-1—1999/A1—2003, Heating boilers with forced draught burners, Terminology, general requirements, testing and marking: cen.eu/cen/Products/Search/Pages/default.aspx
 - 2. EN 303-2—1998/A1—2003, Heating boilers with forced draught burners, Special requirements for boilers with atomizing oil burners: cen.eu/cen/Products/Search/Pages/default.aspx
 - 3. EN 303-3—1998/AC—2006, Gas-fired central heating boilers, Assembly comprising a boiler body and a forced draught burner: cen.eu/cen/Products/Search/Pages/default.aspx
 - 4. N 303-4—1999, Heating boilers with forced draught burners, Special requirements for boilers with forced draught oil burners with outputs up to 70 kW and a maximum operating pressure of 3 bar, Terminology, special requirements, testing and marking: cen.eu/cen/Products/Search/Pages/default.aspx

5. EN 303-5—2012, Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW: cen.eu/cen/Products/Search/Pages/default.aspx
6. EN 303-6—2000, Heating boilers with forced draught burners, Specific requirements for the domestic hot water operation of combination boilers with atomizing oil burners of nominal heat input not exceeding 70 kW: cen.eu/cen/Products/Search/Pages/default.aspx
7. EN 303-7—2006, Gas-fired central heating boilers equipped with a forced draught burner of nominal heat output not exceeding 1000 kW: cen.eu/cen/Products/Search/Pages/default.aspx

- E. Recycling Certification Institute: Includes a list of registered and certified recyclers:
www.recyclingcertification.org
- F. Resources available from the King County Solid Waste Division Construction Recycling and Green Building Program (<http://your.kingcounty.gov/solidwaste/greenbuilding/county-green-building.asp>) and the City of Seattle include:
1. "Prevent Jobsite Waste" Guidelines to prevent waste for occurring in the first place.
<http://your.kingcounty.gov/solidwaste/greenbuilding/jobsite-waste.asp>

1.3 DEFINITIONS

- A. Alternative daily cover (ADC): Material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. For LEED, ADC is considered waste and not diverted material.
- B. Certified Commingled Recycling Facility: A Recycling Facility (see below) that accepts commingled waste and is certified by the Recycling Certification Institute or approved equivalent.
- C. Commingled Waste: Building waste streams that are combined on the project site and hauled away for sorting into recyclable streams. Also known as single-stream recycling.
- D. Construction & Demolition Waste (C&D): All non-hazardous solid wastes resulting from construction and demolition activities. C&D waste includes, but is not limited to, building materials, demolition rubble, landscaping materials, soils, packaging materials, debris, and trash.
- E. Certified Commingled Recycling (CORR)- Facility: Recycling facility certified by the Recycling Certification Institute or approved equivalent.
- F. Hazardous Waste: Any material or byproduct of construction that is regulated by Environmental Protection Agency and that may not be disposed in landfill or other waste end-source without adherence to applicable laws. Includes lead and asbestos.
- G. Land-clearing debris: Excavated soils and related vegetation; these are not considered construction, demolition, or renovation waste that can contribute to waste diversion.
- H. Landfill: Public or private business involved in the practice of trash disposal.
- I. Material Recovery Facility (MRF): A general term used to describe a waste-sorting facility. Mechanical, hand-separation, or a combination of both procedures are used to recover recyclable materials from other waste, which is then disposed of as trash.
- J. Material Stream: Materials coming from a job site into markets for building materials; a stream is either a specific material category that is diverted in a specific way; or a mixture of several material categories that are diverted in a specific way, such as deconstructed materials sent to reuse markets or commingled waste sent to a mixed-waste recycling facility.
- K. Proper Disposal: As defined by the jurisdiction receiving the waste.
- L. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product. Can be conducted on site (as in the grinding of concrete and subsequent reuse on site).

- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of a new product. Recycling facilities have their own specifications for accepting materials. Depending on the type of facility, it may accept source-separated waste or co-mingled waste or both.
- N. Recycling Services. Types of services include:
 - 1. Source-Separated: Construction waste is sorted on the job-site in separate containers as it is generated. The recycling hauler takes the materials directly to a recycler or a transfer site.
 - 2. Co-mingled: This service allows contractors to put select recyclables such as wood, cardboard, and metals in one container. The recycling hauler takes the materials to a sorting facility where the materials are separated for recycling.
- O. Reuse: Making use of a material without altering its form.
- P. Salvage: Recovery of materials for on-site reuse or donation to a third party.
- Q. Trash (or Garbage): That part of the waste that cannot be returned, reused, recycled, or salvaged.
- R. Waste: For the purpose of this section, the term applies to all excess building materials. Waste includes materials that can be salvaged, returned, recycled, or reused. Excludes hazardous waste.
- S. Waste-to-Energy: The conversion of non-recyclable materials into usable heat, electricity or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas (LPG) recovery.

1.4 SUBMITTALS

- A. Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Within fourteen (14) days after receipt of Notice of Award and prior to any waste removal by the Contractor from the Project, the Contractor shall develop and submit to the Owner for review a draft CDWM Plan.
 - 1. The CDWM Plan shall include:
 - a. Identify at least five materials (both structural and nonstructural) targeted for diversion, including an estimate (where reasonably available) of the percentage of overall project waste that these materials represent. Calculations may be based on dry weight or volume, but must be consistent throughout.
 - b. Specify whether construction waste materials will be separated or commingled;
 - c. Describe the diversion strategies planned for the project. Strategies shall include one or more of the following options: contracting with a demolition specialist to salvage all or most of materials generated, selective salvage as part of demolition contractor's work, or reuse of materials on-site or in new construction.
 - d. Identify where the materials will be taken and how the recycling facility will process the material, including expected diversion rates for each material stream.
 - e. Projects where reuse or recycling services are not readily available and that cannot meet diversion thresholds through reuse or recycling alone may claim diversion through waste-to-energy systems, provided they meet applicable standards and requirements (References, Waste-to-Energy). Wood-derived fuel may contribute toward diversion.
 - 2. At a minimum, the CDWM Plan shall be designed to divert the following waste categories from the landfill
 - a. Acoustical ceiling tiles
 - b. Asphaltic concrete paving
 - c. Cardboard (from supplies and packaging)
 - d. Carpet and carpet pad
 - e. Concrete and concrete masonry units (CMU's)
 - f. Excavated soils
 - g. Fluorescent tubes and ballasts (if not recycled designate as hazardous waste)
 - h. Gypsum drywall (clean, unpainted)

- i. Metals
 - j. Paint
 - k. Plastic film (sheeting, shrink wrap, packaging)
 - l. Window glass
 - m. Wood (clean, unpainted, untreated wood scrap including pallets and engineered wood)
 - n. Job-shack wastes, including office paper, blueprints, pop cans and bottles, and office cardboard.
- C. Final CDWM Plan. Within 14 days after Owner has determined that the recycling options addressed in the draft CDWM Plan are acceptable and prior to waste removal, submit the final CDWM Plan.
- D. CDWM Reports
1. The Contractor shall be responsible for CDWM reporting whether directly involved in recycling the materials or not (whether the Contractor performs recycling tasks or hires or requires others to do so, such as subcontractors to haul their own drywall or metal).
 2. For co-mingled materials, the Contractor shall include the co-mingled C&D recycling rate of the receiving facility. Documentation can either be project-specific diversion rate(s) provided by the sorting facility, or if the method of recording and calculating is regulated by the local or state governing authority, the average annual recycled rate for the sorting facility.
 3. Progress Reports. Submit with each Application for Payment a summary of construction waste generated. Include the following:
 - a. For each material recycled, reused, or salvaged from the Project, the amount (in tons or cubic yards), the receiving party, and the net total cost or savings of salvage or recycling the material. Attached manifests, weight tickets receipts or invoices. For co-mingled materials, the Contractor shall include the co-mingled C&D recycling rate of the receiving facility.
 - b. The amount (in tons or cubic yards) of material disposed of as garbage from the Project, the location of the Receiving Facility, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.
 4. Final Report: The Contractor shall submit within (14) calendar days of completing the project a final waste management report detailing all major waste streams generated at the Project, including disposal and diversion rates. The final report shall be submitted on a form acceptable to the Owner's Project Manager and shall contain the following information:

For CDWM Prerequisite and CDWM Credit, Option 1

 - a. The number of material streams diverted.
 - b. Percentage of construction and demolition waste diverted from the landfill.
 - c. Confirmation that ADC is excluded from diverted waste calculations but is included in total construction and demolition waste calculations.
 - d. For each material recycled, reused, or salvaged from the Project, the total amount (in tons or cubic yards), the receiving party, and the net total cost or savings of salvage or recycling the material. Attached manifests, weight tickets receipts or invoices.
 - e. If waste-to-energy systems were used, provide a brief description of how recycling and reuse were used as diversion strategies prior to using waste-to-energy.
 - 1) Provide documentation that the facility follows the European Commission Framework Directive 2008/98/#D and the Waste Incineration Directive 2000/76/EC and meets the applicable European Committee for Standardization (CEN) EN 303 standards.
 - f. The total amount (in tons or cubic yard of material) of material disposed of as garbage from the Project, the location of the Receiving Facility, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.
 - g. Documentation of diversion rate of commingled waste. Can be project-specific rate provided by sorting facility, or if the method of recording and calculating is regulated by the local or state governing authority, the average annual recycling rate for the sorting facility.
 - h. Construction and Demolition Waste Calculator (available from the resources tab of the LEED Credit Library) or equivalent documentation.

1.5 REVENUES

- A. Revenues or other savings obtained from recycled, reused, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents.

PART 2 PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE MATERIALS

- A. Recycled-content, salvaged, rapidly renewable, or otherwise resource-efficient products are specified in appropriate sections.

PART 3 EXECUTION

3.1 IMPLEMENTATION

- A. Implement the CDWM Plan upon start of construction and demolition activities that will generate waste.
- B. Establish on-site infrastructure, practices, and policies for on-site collection, sorting, and tracking system, as applicable.
- C. Track all hauling receipts including reporting of waste taken off site by subcontractors.

3.2 COMMUNICATION

- A. Designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
- B. Distribute copies of the CDWM Plan to each entity performing work at the site.
- C. Use safety meetings, signage, and subcontractor agreements to communicate the goals of the waste reduction plan, including instruction about appropriate separation, handling separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the Project.
- D. Sub-contractors must report all waste and how much was diverted that they take off site that is not controlled through the on-site collection system being monitored by your CWM plan.

3.3 MATERIALS CONSERVATION

- A. Protect products from damage during storage, installation, and in-place. Materials that become wet or damp due to improper storage shall be replaced at contractor's expense.
- B. Include in supply agreements a waste reduction provision specifying a preference for reduced, returnable, and/or recyclable packaging.
- C. Use detailed take-offs and use to identify location and use in structure to reduce risk of unplanned and potentially wasteful cuts.

3.4 MATERIALS HANDLING

- A. Designate specific area(s) to facilitate separation of materials for potential recycling, salvage, reuse and return. Maintain recycling and waste bin areas clean and clearly marked to avoid co-mingling of materials. Bins shall be protected during non-working hours from off-site contamination.
 - 1. Separate recycling waste in accordance with requirements of recycling facility/hauler.

- B. Protect materials to be recycled or reused from contamination. Handle, store, and transport materials in a manner that meets the requirements of the designated acceptance facility.
- C. Separately store and dispose of hazardous wastes according to local regulations.
- D. As part of regular clean-up, schedule and conduct visual inspections of dumpsters and recycling bins to identify potential contamination of materials.
- E. Burning or burying of C&D waste is not permitted.

END OF SECTION

SECTION 017700 – CLOSEOUT PROCEDURES

GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for Contract closeout including, but not limited to:
 - 1. Project Record Set
 - 2. Operation and Maintenance Manuals
 - 3. Warranties and Bonds Manual
 - 4. Demonstration and Training
 - 5. Cleaning
 - 6. Owner's Final Inspection
 - 7. Substantial Completion
 - 8. Final Completion, and
 - 9. Final Acceptance
- B. Related Sections
 - 1. Section 01 33 00 – Submittal Procedures
 - 2. Section 01 33 00.11 – Submittal Standards Requirements and Compliance Review Exhibit
 - 3. Section 01 78 23 – Operation and Maintenance Data
 - 4. Section 01 78 23.11 – Facilities Management Data Requirements for Operations and Maintenance
 - 5. Section 01 78 36 – Warranties
 - 6. Section 01 79 00 – Demonstration and Training
 - 7. Section 01 91 00 – General Commissioning Requirements
- C. For additional specific construction Work, closeout requirements are described in Divisions 02 thru 49 of the Specifications.

1.2 PROJECT RECORD SET

- A. General: Project Record Set documents are the final design drawings and specifications that have been updated by the A/E to include all of the RFI, ASI, and other changes to the contract documents as well as the changes indicated on the Contractor's final red-line as-built Drawings.
- B. The Contractor shall be required to provide their final red-line as-built Drawings and Specifications as soon as possible and submit them to the Owner so that A/E can produce the final record set.
- C. Contractor's As-built Drawings: Maintain red line prints of the bid set Contract Drawings and approved Shop Drawings. Mark the drawings to show new information that was not shown on the bid set Drawings, and on the approved Shop Drawings, including the actual installation where the installation varies substantively from the work as originally shown. Mark drawings to show conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Organize as-built Drawings in manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.

2. Mark with reproducible pencil and distinguish between variations in separate categories of the Work. Text size is to be 1/8" minimum. Good basic drafting practice must be applied.
 3. Show bid addenda items, Change Orders, and Request for Information (RFI) responses by their number and date the revisions with a "cloud" around the revision.
 4. Keep accurate measurements of below-grade site work, including permanent shoring, in accordance with Section 01 71 23 "Field Engineering."
 5. Show mechanical dampers, valves, reheat boxes, cleanouts, and other equipment and items that require maintenance.
 6. Show location of construction-concealed mechanical, electrical and plumbing (MEP) riser installations including, but not limited to, piping, ductwork, and conduits referenced to visible and accessible features.
 7. Show field changes of dimensions and details.
 8. X-out conditions not constructed and appropriately annotate "not constructed" to convey the actual as constructed condition.
- D. As-built Specifications: Maintain one (1) copy of the bid set Contract Specifications showing all addenda, substitutions, Change Orders, and RFIs. Give particular attention to the selection of options, changes in product data, and information on elements engineered by the Contractor and note related as-built Drawing information, as appropriate. Clear, legible documentation must be applied.
- E. As-built Shop Drawings: The Contractor shall comply with the following CAD (Computer-Aided Drafting) standards and requirements when preparing BIM and as-built Shop Drawings required by the Contract Documents.
1. Cover sheets shall contain a complete index of all sheets.
 2. Symbols shown must be symbols used in the Contract Documents.
 3. Standard drafting practice shall be:
 - a. Title block
 - 1) All sheets shall have a title block.
 - 2) Title block information is to be on the right side of the sheet.
 - 3) Title blocks shall include the following information:
 - a) Date
 - b) Project Name
 - c) Project Number
 - d) Sheet name
 - e) Sheet number
 - f) Contractor or Subcontractor company name
 - g) A/E's Seal (whoever prepared the drawing)
 - h) A Key Plan
 - b. Area of Work: CAD drawings shall include a boundary that defines the area of work, showing only the area where work is performed.

4. CAD Compliance Submittal Review Requirements: CAD Shop Drawings shall be electronically submitted for Owner's CAD compliance review and approval prior to submitting the final as-built Shop Drawings. The Contractor may request a compliance review at any time during the work prior to Substantial Completion. Refer to specification section 01 33 00.11 – "Submittal Standards Requirements and Compliance Review Exhibit" for electronic submittal formatting requirements.

1.3 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. The O&M Manuals shall contain all the information needed to operate, maintain and repair all systems, equipment, and product finishes provided in the Project.
- B. Refer to specification section 01 78 23 – "Operation and Maintenance Data" for content, format, and submittal requirements of the O&M documentation.
- C. The Contractor shall maintain the O&M documentation throughout the construction and turnover phases of the project, up to the Final Completion submission of the O&M required to be provided just prior to final payment request by the Contractor. During the closeout phase of the project, the Contractor shall make two milestone submittals of the O&M documentation for review and approval. The Contractor shall revise the documentation to incorporate all review comments. The milestone submittals shall be as follows:
 1. Substantial Completion Draft Submittal: This submittal shall be in both print form and electronic form. This submittal will be used as a review set by the A/E, Owner, and Commissioning Authority to ensure that the Contractor has prepared the documentation to be in compliance with the requirements of section 01 78 23 – "Operation and Maintenance Data" and is complete except for items that cannot yet be completed at the time of Substantial Completion for the project such as ongoing as-built drawings, etc. However, all documentation required by the Contractor shall still be included in this review set, in their present state, even if they are not yet completed.
 2. Final Completion Record Set Submittal: This submittal shall be in both print form and electronic form. This submittal shall be fully completed. The Contractor shall use the Substantial Completion Draft submittal (electronic and printed versions) as the basis and update it for the Final Completion Submittal. The Contractor shall clearly indicate what has changed from the Substantial Completion Draft Submittal. The documents will be reviewed by the A/E, Owner, and Commissioning Authority for full compliance with the requirements of section 01 78 23.
- D. The Contractor shall use the O&M documents, in their current state, as a presentation reference for the demonstration and training activities. The Contractor shall ensure that the O&M documentation is complete for the materials presented at each training session that are associated with that session.

1.4 WARRANTIES AND BONDS MANUAL

- A. Assemble executed warranties and bonds, and any certificates from the respective manufacturers, suppliers, and Subcontractors. Provide preliminary review copies of all warranties and bonds and a final manual with the original documents, titled, "Warranties and Bonds Manual." Refer to specification section 01 78 36 – "Warranties" for requirements relating to content, formatting, and submittals of the warranties and bonds documentation.

1.5 DEMONSTRATION AND TRAINING

- A. The Contractor shall provide on-site instruction, demonstration, and training for Owner's personnel in all aspects of the philosophy, operation and maintenance of equipment and systems. Demonstration and training shall be provided by a qualified trainer from the Contractor or Subcontractor who supplied and installed the equipment and/or systems or a manufacturer's training representative who is familiar with all aspects of the design, operation, maintenance, and troubleshooting of the specified equipment and systems. Training shall be conducted with appropriate schematics, handouts, and audio/visual aids, as well as the most current O&M documentation relating to the training topic. All training shall be digitally recorded in video. Attendance shall be recorded. For work requiring commissioning, see Section 01 91 00 "General Commissioning Requirements" for further training session agenda requirements.
- B. Refer to specification section 01 79 00 – "Demonstration and Training" for requirements relating to preparation of the Owner Training Plan, the types of training to be performed, training agenda submittals, training schedule, and training content and format.

1.6 CLEANING

- A. Contractor clean up during construction is specified in the Contract Documents.
 - 1. If Contractor fails to clean as specified in the Contract Documents, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be charged to Contractor.
 - 2. Contractor shall employ continuous housekeeping cleaning during construction to minimize interior construction dust and particulates during the Work.
- B. Preliminary Cleaning: Perform the following preliminary cleaning operations as a prerequisite for Owner's Final Inspection. Although the Contractor is responsible for this Work, the actual costs shall be included in the Division 02 through 49 subcontract bid packages. The following are examples, without limitation, of minimum cleaning requirements:
 - 1. Remove labels that are not permanent.
 - 2. Remove temporary protective coatings and wrappings from all products.
 - 3. Remove glazing compounds and other vision-obscuring substances from transparent and reflective materials provided by the Contractor including, but not limited to, mirrors, glass in doors and interior construction, glass canopies and skylights, and windows inside and out.
 - 4. Clean all exposed building interior surfaces, including cabinet interiors, and new exterior surfaces to be free of foreign substances including, but not limited to, stains and films.
 - 5. Leave floors broom-clean. Vacuum carpeted surfaces and clean consistent with manufacturer's recommendations for installation.
 - 6. Remove and clean all construction debris and refuse from:
 - a. Roofs, mechanical and electrical rooms, and equipment vaults
 - b. Limited access spaces including above ceiling areas and shafts
 - c. Physically inaccessible components of the Work including wall and chase cavities, gutters and downspouts, floor drains and other drainage systems
 - 7. Wipe surfaces of M&E equipment. Remove excess lubrication and other substances.

8. Clean the Project site of construction waste, rubbish and litter. Sweep paved areas broom clean and remove stains, spills, and other foreign deposits.
- C. Final Cleaning: Prior to Substantial Completion, employ experienced workers or professional cleaners for final cleaning of the Work. Clean to a condition expected of a normal commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Final cleaning is a negotiated support service.
1. Leave entire Project clean and ready for occupancy. All new interior, including cabinet interiors, and exterior building surfaces, fixtures and equipment shall be turned over to the Owner in a new condition, free of all damage, dust, dirt, spots, stains, encrustations, and other blemishes.
 2. Clean transparent materials including mirrors, glass in doors and interior construction, glass canopies and skylights, and windows inside and out.
 3. Clean plumbing fixtures to a sanitary condition.
 4. Clean light fixtures and lamps.
 5. Apply floor finishes.
- D. Compliance: The Contractor shall:
1. Use non-toxic Green Seal Certified cleaning products, or products with low-volatile organic compounds (VOC), and cleaning paper with a post-consumer recycled content
 2. Employ equipment with high efficiency particulate filtration and sweep compound to keep dust down
 3. Comply with current regulations and standards of authorities having jurisdiction and the safety standards for cleaning specified in manufacturer's instructions.

1.7 OWNER'S FINAL INSPECTION

- A. Prior to Final Inspection: The Contractor shall satisfactorily complete the following actions prior to the Owner's final inspection of the Project.
1. Submit written notice that the Project is ready for final inspection. Include a copy of the Contractor's final punch list report (see Section 01 45 00 "Contractor Quality Control") and list all incomplete work items that have been reviewed with the Owner, and which the Owner has agreed are not necessary prior to Substantial Completion.
 - a. Include a written plan/schedule outlining all actions necessary to achieve Substantial Completion, without requiring extra ordinary participation by Owner and A/E.
 2. Complete preliminary cleaning operations.
 3. Submit the Owner Training Plan, including the completed training calendar, for Owner's review and comment.
 4. Replace all ventilation systems air filters specified for construction with final filters.
 5. Complete start-up and functional performance testing of all systems required by the Contract Documents and AHJ including, but not limited to: electrical testing;

environmental control systems point-to-point testing; emergency eyewash and safety shower testing; and HVAC air balancing.

6. Submit one (1) hard copy each of the current air balancing report and the M&E Commissioning Binders labeled "Preliminary," listing all deficiencies, for Owner's review and comment.
- B. Owner's Final Inspection: Upon satisfactory completion of the actions in 1.7A, Owner will determine if the Project is complete and ready for final inspection and, at Owner's sole discretion, commence final inspection, or provide a written deficiency list of items to the Contractor of work that must be completed to the satisfaction of the Owner prior to Owner's final inspection. Final inspection is performed by the A/E and Owner's representatives.
1. After the Owner has issued the final inspection list of corrective work items, the Contractor shall make the required corrections and/or identify items that the Contractor feels are not required by the Contract Documents, and resolve these items with the Owner.
- C. Re-inspection: Contractor shall request, in writing, re-inspection after completing the Owner's final inspection list of corrective work items and providing the Owner the final inspection report notated with a signed-off approval for each of the corrected items. Those items whose completion is delayed due to circumstances acceptable to the Owner will be exceptions. The Owner's Representative will back check the items or have the A/E perform a re-inspection.
1. If the A/E is required to perform more than one re-inspection, the costs for additional inspections may be borne by the Contractor, at the Owner's sole discretion.

1.8 SUBSTANTIAL COMPLETION

- A. Substantial Completion: Substantial Completion (for either the entire Work or portions thereof) shall be achieved when all Work, other than incidental corrective and incidental punch list work, is complete including, but not limited to, the following actions:
1. Complete final cleaning operations.
 2. Submit the "Substantial Completion Draft Submittal" of the operations and maintenance data for Owner's review and comment in one (1) hard copy and in an approved digital format.
 3. Submit all sign-offs, releases, jurisdictional settlements, judgments, and other records from AHJ allowing the Owner's full and unrestricted use and benefit of the facilities including, but not limited to, a temporary or permanent certificate of occupancy permit, operating permits and/or licenses for the use of building equipment and similarly necessary certificates and releases.
 - a. Provide a list of any outstanding work required by AHJ.
 4. Submit the current As-Built Drawings and Specifications identified "Preliminary" As-Built (marked with the date of submission) in the required Substantial Completion Draft Submittal.
 5. Submit the As-Built Shop Drawings required by the Contract Documents and, when specified, the BIM in accordance with this Section 1.2D.5, in the required Substantial Completion Draft Submittal.

6. Remove all construction tools and temporary facilities not required for Final Completion work from the Project site including, but not limited to, storage sheds, samples and mock-ups, Project identification signage, site fences, crane and hoist base foundation construction, temporary enclosures, and construction electrical power and service.
 7. Complete Owner's personnel demonstration and training and submit video files in the required Substantial Completion Draft Submittal.
 8. Deliver specified maintenance equipment and tools to Owner, with itemized summary list.
 9. Complete final change-over of locks, transmit new keys to Owner, and return Owner's loaned construction keys.
 10. Complete all air balancing, testing and commissioning work required by the Contract Documents, allowing the Owner to fully occupy the Work for the use for which it is intended. Incidental Work, that is not life safety or occupational safety commissioning work, whose completion is delayed due to circumstances excused by the Owner, will be the exception.
 - a. Submit one (1) hard copy each of the current air balancing report and M&E Commissioning Binders (marked with the date of submission) noting the corrections for deficiencies listed in the "Preliminary" report and binders and indicating any incomplete Work.
 11. Submit all controls systems software files required by the Contract Documents including, but not limited to, lighting and environmental controls.
- B. Substantial Completion: Upon a satisfactory completion of the actions in 1.8A above and the General Conditions requirements for Substantial Completion, the Owner will prepare a letter of Substantial Completion and forward to Contractor. The letter will identify the date of Substantial Completion and include the final punch list report and the commissioning deficiencies list, listing all remaining incomplete work. Contract warranties will begin as of the date of Substantial Completion, as specified in Section 01 78 36 "Warranties," or as otherwise indicated in the Contract Documents.
1. Substantial Completion and the start of warranties for incomplete items will be established in writing by the Owner when the item is determined complete.

1.9 FINAL COMPLETION

- A. Prior to Final Completion: Final Completion shall be achieved when the Work is fully and finally complete, to the Owner's satisfaction in accordance with the Contract Documents including, but not limited to, the following:
1. All Work, including incidental corrective or punch list work, and air balancing and commissioning work (if included in the scope of the Work) is complete and correct to the satisfaction of the Owner.
 2. All remaining temporary facilities are removed from the Project site and the site (including landscape) is restored to original conditions or Contract Documents requirements.
 3. All final permits, originally issued as temporary permits, have been submitted.

4. The final marked-up As-Built Drawings and Specifications identified Final As-Built (marked with the date of submission) have been submitted in hard copy; and in the Final Completion Record Set Submittal.
 5. The complete operations and maintenance data has been submitted in hard copy and in the Final Completion Record Set Submittal.
 6. A separate, bound hard copy of the Warranties and Bonds Manual, with original documents, has been submitted.
 7. The Contractor's final 3-ring binder of all MSDS used for construction, marked with the date of submission, has been submitted in PDF format.
 8. The Contractor's final cumulative Construction Waste Management Report (marked with the date of submission) has been submitted in PDF format.
 9. All Change Orders are approved and signed by both parties.
 10. A draft of the Final Application for Payment has been submitted to Owner for review and approval.
 11. The final Schedule of Values and the Building Componentization Report in hard and electronic copies (see Section 01 29 76 "Progress Payment Procedures") have been submitted.
 12. The final air balancing report and the final M&E Commissioning Binders (marked with the date of submission) have been submitted in PDF format.
 - a. For Projects with a Test Engineer, the as-built information updating the A/E commissioning basis-of-design has been submitted with the Commissioning Binders.
 13. Specified spare parts, extra stock of materials, and extra materials of value to the Owner, with itemized summary list, have been submitted.
 14. The "Regulated Materials – Waste Manifests" (marked with date of submission) have been submitted in PDF format.
- B. Final Completion: Upon satisfactory completion of the requirements in 1.9A above to achieve Final Completion, the Owner will approve and process the final Application for Payment and establish the date of Final Completion thereon.

1.10 FINAL ACCEPTANCE

- A. Final Application for Payment has been approved by Owner and payment made to the Contractor.
- B. The Owner will establish the date of Final Acceptance and issue the letter of Final Acceptance after the Contractor has completed the requirements of the Contract Documents.
 1. The Contractor shall follow the requirements outlined in the General Conditions and Section 01 29 76 "Progress Payment Procedures" for release of retainage.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017823 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Description: This section includes administrative and procedural requirements for providing operation and maintenance (O&M) documentation, including the following:
 - 1. Schedule of deliverables and timeline for O&M documentation,
 - 2. Deliverable format for the documentation,
 - 3. Scope of content for the O&M documentation.
- B. Related Sections:
 - 1. Section 01 32 16 - Construction Progress Schedule
 - 2. Section 01 33 00 - Submittal Procedures
 - 3. Section 01 33 00.11 – Submittal Standards Requirements and Compliance Review
 - 4. Section 01 77 00 - Closeout Procedures
 - 5. Section 01 78 23.11 – Facilities Management Data Requirement for O&M
 - 6. Section 01 78 36 - Warranties
 - 7. Section 01 91 00 - General Commissioning Requirements

1.2 DOCUMENTATION SUBMITTALS TIMELINE

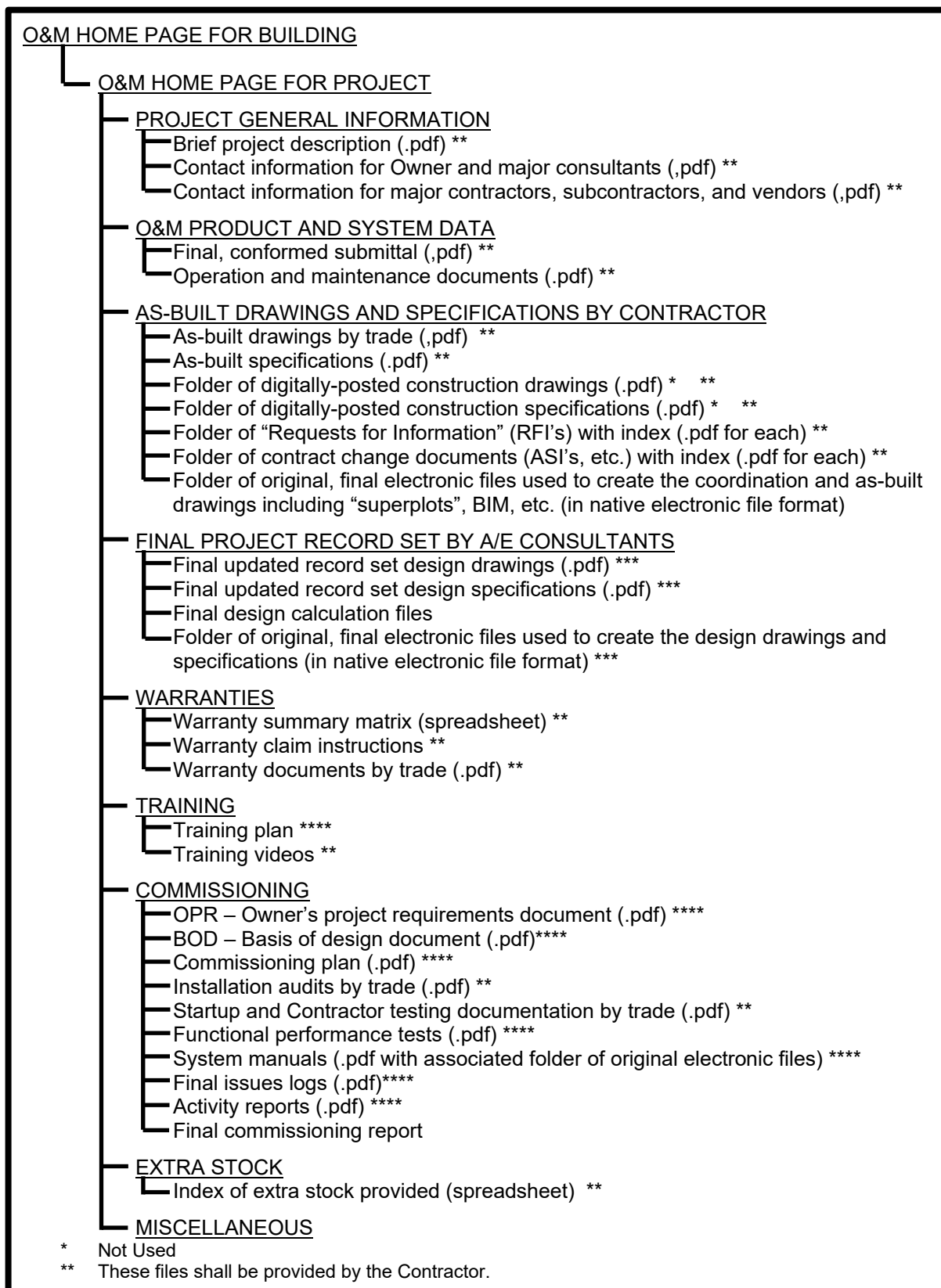
- A. General:
 - 1. The operation and maintenance (O&M) documentation, including print and electronic versions, shall be submitted at defined milestones of the construction and turn-over phases for the project, as described in this specification section. At each milestone, the Contractor shall submit the document for review and approval by the Architect/Engineer Consultants (A/E), Owner, and Commissioning Authority (CxA).
- B. Milestone Submittals Timeline:
 - 1. O&M Formatting Review Draft Submittal: The Contractor shall submit this document, in electronic format only, prior to starting the product and shop drawing submittal process in order to establish that the organization and formatting of the O&M document meets the requirements of the Owner's standards for O&Ms.
 - 2. Substantial Completion Draft Submittal: The Contractor shall submit this document, in both print and electronic format, 2 weeks prior to the Substantial Completion date.
 - 3. Final Completion Record Set Submittal: The Contractor shall submit this document, in both print and electronic format, 2 weeks prior to final payment request.

PART 2 - PRODUCTS

2.1 DOCUMENTATION FORMAT

- A. Electronic Files Requirements:
 - 1. Electronic files provided by the Contractor shall comply with the requirements in Section 01 33 00.11 – “Submittal Standards Requirements and Compliance Review Exhibit”.

Diagram 1 – O&M Directory Structure:



*** These files shall be provided by the A/E designers.

**** These files shall be provided by the Commissioning Authority.

B. Electronic File Naming Conventions:

1. The electronic files that are linked to in the O&M documents shall be named in a manner consistent with the Owner's standard file naming convention for O&M documentation.

C. Print Media Documentation:

1. In addition to the electronic submittals, the Contractor shall also submit one (1) hard (printed) copy of the O&M documentation for the Substantial Draft Submittal and the Final Completion Record Set Submittal reviews.
2. Operation and Maintenance Manual Documentation:
 - a. The printed documentation shall be submitted as a collection of 3-ring binders as well as separate As-Built drawing sets organized according to the following three main disciplines:
 - 1) Architectural
 - 2) Mechanical
 - 3) Electrical
 - b. Binders shall be extra heavy-duty type slant-D, 3-ring binder with clear vinyl overlay to insert front, spine, and back covers.
 - c. Provide a cover slip sheet and a spine sheet typed with ARCHITECTURAL/SITE, MECHANICAL, and/or ELECTRICAL – OPERATIONS AND MAINTENANCE MANUAL, project name, project number, facility name, A/E name, and Contractor name. Label manuals consecutively for each discipline. Each manual shall have a typed index and tabbed dividers between chapters and sections. Where more than one piece of equipment is included within a chapter, the Contractor shall use slip sheets or sub-dividers to separate the pieces of equipment. Sub-dividers must be approved by the Owner to demonstrate an orderly and clear organization of dividers.
 - d. Contents of the manual shall be printed on white 8-1/2"x11" acid-free, recycled paper. If 11"x17" sheets are included, the Contractor shall fold them to fit within the space of an 8-1/2"x11" page for consistency. If larger sheets are included, the Contractor shall include 3-ring binder sleeves so that the larger sheets can be folded to fit within the binder and be secured.
 - e. The documentation for each major discipline may require the use of more than one 3-ring binder.
3. The print media documentation shall only include the O&M section materials..

2.2 DOCUMENTATION CONTENT

A. Electronic Files Requirements:

1. Electronic files provided by the Contractor shall comply with the requirements in Section 01 33 00.11 – "Submittal Standards Requirements and Compliance Review Exhibit".

B. Non-Duplication of Content:

1. The Contractor shall not duplicate document content in more than one location within the O&M in order to ensure that correct version control can be maintained. For example, if a shop drawing is provided as part of a Submittal document, and included

within the O&M section, the Contractor shall not provide that same shop drawing within the As-Built section, but shall instead include a reference note within the as-built drawing section that points the user to look in the O&M section for that document.

C. O&M Section Content:

For all of the final submittal documents, the Contractor shall include the following documentation when they exist:

1. Final Approved Submittal: Include the manufacturer's product brochure and technical literature assembled specifically for the project and excluding irrelevant materials, as well as providing the final, approved submittal.
 - a. Each product data sheet shall be clearly marked to identify the specific products and components used in the installation and the data applicable.
 - b. Mark the header of the documents with the identification tag indicated on the design drawings or specifications.
 - c. Provide additional instructions and illustrations as required to identify any changes to the manufacturer's data or to illustrate the function of each component in the installation.
 - d. Include performance, ratings, and engineering data for the equipment.
 - e. Include a brief description of how the equipment operates as well as a detailed sequence of operation.
 - f. Include controls diagrams where applicable.
 - g. When there is more than one submission/review for a particular submittal, the Contractor shall consolidate the submittals such that the Final, Approved Submittal included in the O&M is just one comprehensive submittal that shows the final and complete version of the submittal.
2. Installation Instructions: Include a copy of the manufacturer's installation instructions specific to the provided equipment and marked-up to indicate options provided or crossed-out where the documentation materials do not apply.
3. Operation and Maintenance Instructions: Include a copy of the manufacturer's operation and maintenance instructions for the equipment as well as notes provided by the Contractor or Vendor that would assist the Owner in the future maintenance or operation of the equipment. The Contractor shall mark up the operation and maintenance materials to indicate which options have been provided for the project and strike out portions of the materials that do not apply to the specific equipment provided. The documentation shall include the following information:
 - a. Safety precautions,
 - b. Equipment or system break-in procedures,
 - c. Startup procedures,
 - d. Routine and normal operating instructions,
 - e. Normal shutdown instructions,
 - f. Emergency shutdown instructions,
 - g. Seasonal operating instructions,
 - h. Troubleshooting procedures,
 - i. Required sequences for electric or electronic systems,
 - j. Special operating instructions and procedures,
 - k. Schedules of the parameter settings for each protective device, including fixed and adjustable circuit breakers, protective relays, adjustable photoelectric switches, pressure switches, and any other control and monitoring device, as established during commissioning and construction maintenance periods,
 - l. A listing of maintenance tasks to be performed,
 - m. Step-by-step instructions for each maintenance task,
 - n. Recommendations for scheduled intervals for performing each maintenance tasks.

4. Parts Identification: Identification of each component, including exploded view diagrams and a complete parts list.
5. Tools and Testing Instrumentation: Provide a list of special tools and testing instrumentation necessary for maintenance and testing of the equipment as well as detailed instructions for their use, if provided for the project.
6. Spares and Consumables: Provide a recommended schedule of spares (including bearings when the expected operating life less than 40,000 hours), and a schedule of recommended consumable items to be used during servicing.
7. Wiring Diagrams: Provide a copy of the actual wiring diagram shipped with the equipment. Generic wiring diagrams included with the manufacturer's standard O&M documentation shall not be acceptable.
8. Performance Charts: Provide a copy of any performance charts or criteria associated with the equipment including fan curves, minimum/maximum operating conditions, etc.
9. Operating Logs: Where operating logs are required to be kept during the time period when the Contractor is operating the equipment, include those logs.
10. Special System Information: The following special information shall also be included:
 - a. As-built door hardware schedule and submittal documentation.
 - b. Refrigeration controls schematics / sequence of operation documentation.
 - c. Motors data and variable frequency drives (VFDs) documentation including final settings programmed into the VFDs.
 - d. Fan and pump curves documentation.
 - e. HVAC filters schedules.
 - f. Environmental controls systems (ECS) documentation including hardware and software manuals.
 - g. Electrical short circuit coordination and arc flash study report.
 - h. Electrical transformer factory testing reports.
 - i. Pool related systems including; filters, pumps, chemical control systems
11. Product Materials Maintenance Documentation: Where architectural product materials are included in the submittal, the Contractor shall provide the following information:
 - a. Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, and repair materials as described below.
 - b. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
 - c. Product Information: Include the following, as applicable:
 - 1) Product name and model number.
 - 2) Manufacturer's name.
 - 3) Color, pattern, and texture.
 - 4) Material and chemical composition.
 - 5) Reordering information for specially manufactured products.
 - 6) Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 7) Inspection procedures.
 - 8) Types of cleaning agents to be used and methods of cleaning.

- 9) List of cleaning agents and methods of cleaning detrimental to product.
- 10) Schedule for routine cleaning and maintenance.
- 11) Repair instructions.

D. As-Built Drawings Content

1. Refer to specification section 01 77 00 – “Closeout Procedures” for requirements relating to formatting and content of the Contractor’s As-Built drawings and specifications.
2. The Contractor shall revise the as-built drawings and specifications to reflect the most current state of the installed conditions and submit those documents within the O&M.
3. It is expected that the various Subcontractors and Vendors will produce as-built drawings using different methods. Some may produce them from BIM models, or from AutoCad drawings, or from proprietary software, or from red-line mark-ups of design set hard copy drawings. However, the end product to be included in this O&M shall be sets of .pdf documents.
4. The as-built drawings shall consist of all Contractor-produced drawings and details used for the purpose of detailing the dimensionally-correct “as-installed” representation of the final construction as well as any Contractor-produced documents of Contractor-performed design/engineering documents required to complete the construction. Examples of as-built drawings include, but are not limited to:
 - a. A pdf floor plan of the HVAC ductwork layout, prepared by the Mechanical Subcontractor, that includes the dimensions of the actual installed construction with ductwork specialties included represented in a dimensionally-correct manner,
 - b. A marked-up red-lined drawing on a hard copy of an architectural design drawing print, prepared by an Architectural Vendor, that is then scanned into a pdf electronic file,
 - c. An engineered shop drawing package, prepared by the Building Automation System controls vendor, that includes the vendor-performed engineering drawings, calculations, and details, etc. required to describe their bill of materials, how their system will be constructed, wired together, programmed, sequenced, etc., all in pdf format,
 - d. An engineered shop drawing package, prepared by the Fire Alarm vendor, that includes the vendor-performed engineering drawings, calculations, and details, etc. required to describe their bill of materials, how their system will be constructed, wired together, programmed, sequenced, etc., as well as shows the actual devices provided and where they are located on the floor plans, etc., all in pdf format.

E. Startup/Test Report Documentation Content

1. Upon completion of a test or startup activity, the Contractor shall include the supporting documentation in the O&M documentation within 2 weeks of completing that activity.
2. The Contractor shall notify the Owner, by transmittal, when each startup documentation and test report is uploaded to facilitate timely review of the documentation by the A/E, Owner, and CxA.
3. The Contractor shall organize the test reports and startup documentation by discipline and then by system and then equipment.

4. The required startup documentation for the project is defined in other sections of these specifications, including the commissioning sections.
- F. Warranty Section Content
1. Include the complete warranty and bond documentation in the Initial Review Draft submittal.
 2. Refer to section 01 78 36 – “Warranties” for the scope of content to be included for warranty documentation.
 3. Organize the warranty information by discipline (building trade) and then , if needed, by system and then by equipment.
- G. Training Section Content:
1. Include the completed training plan.
 2. Include all training videos in the highest quality “.mp4” electronic file format. For videos that the Contractor has obtained from the manufacturer, include the written permission documents from the manufacturer stating that the manufacturer grants the Owner use of the video files for their use.
 3. If the electronic files are greater than 2 gigabytes in size, break the video into multiple parts.
- H. Commissioning Content:
1. The Commissioning Authority will provide the documentation under this section except for the Installation Audit and Startup/Test Report sections that are required to be completed by the Contractor.
- I. Extra Stock Content:
1. Include a summary spreadsheet of all of the extra stock required and provided for the project.
 2. Each line item shall include the specification reference, the actual products provided (including manufacturer, model numbers, etc.), the quantity provided, and where the stock was left on site (or at the agreed upon location), at the end of the project.
 3. Include a picture of the extra stock at the locations where they were left at the end of the project.
- J. Miscellaneous Content:
1. The content of this section may vary by project. This section is intended to allow for additional documentation to be stored, as needed by the project or as desired by the Owner.

PART 3 - EXECUTION

3.1 MILESTONE SUBMITTAL: O&M FORMATTING REVIEW DRAFT:

- A. This submittal shall be electronic only. The contractor shall submit (2) electronic copies on USB drive media.
- B. The purpose of this submittal is for the Contractor to develop the O&M formatting and file directory structures so that the organization can be reviewed and approved by the Owner, A/E, and (Cx)A. The Contractor shall comply with all Owner requirements for formatting and naming conventions, organization, navigation, and content.
- C. The Contractor shall not be required to provide the technical O&M information for this submittal. Only the organization, formatting, navigation, and project general information section will be reviewed.
- D. For this submittal, the Contractor shall create the O&M and complete the following tasks:
 - 1. The Contractor shall prepare the "index" of documents on each of the applicable O&M page for the documents that they are required to provide within the O&M. Each index shall be a comprehensive listing of all the documents to be provided for that O&M page and shall describe clearly and intuitively what the document is. The purpose of this requirement is for the Contractor to demonstrate how they will be organizing the documents as well as demonstrate to the Owner that the documentation will be comprehensive. The Contractor shall be responsible for ensuring that all required documentation is included.
 - 2. Project Home Page: The Contractor shall fill in and complete with all of the project-specific information.
 - 3. Project General Information Section: The Contractor shall project general information page shall be fully completed including the project description document and the two contacts documents.
 - 4. O&M Section: The Contractor shall create the "index" on each of the individual trade pages in this section.
 - 5. As-Built Drawings and Specifications Section: The Contractor shall create the "index" on each of the individual trade pages in this section.
 - 6. Test Reports and Startup Documentation Section: The Contractor shall create the "index" on each of the individual trade pages in this section.
 - 7. Warranties Section: The Contractor shall create the "index" on each of the individual trade pages in this section. The hyperlinks associated with the line items in each index do not need to be created for this submittal. The Contractor shall also fully complete the Warranties Summary Matrix Document and produce the "Warranty Claim Initiation Instructions" document.
 - 8. Training Section: The Contractor shall create the "index" on each of the individual trade pages in this section.
 - 9. Commissioning Section: The Contractor shall create the "index" on each of the individual trade pages for the Installation Audit and Startup/Test Reports subsections.

3.2 MILESTONE SUBMITTAL: SUBSTANTIAL COMPLETION DRAFT:

- A. This submittal shall be in electronic and printed media formats. The contractor shall submit two (2) electronic copies on USB drive media. The Contractor shall also prepare one (1) hard copy (printed media).
- B. The purpose of this submittal is to conduct a review of the documentation for its compliance to the O&M submittal prerequisites for the Contractor to obtain Substantial Completion status from the Owner. All sections of the O&M documentation shall be completed by the Contractor for this submittal.
- C. If, after Substantial Completion status is obtained, there is ongoing work that affect the content of this O&M documentation, the Contractor shall continue to keep the O&M documentation current. The Contractor shall continue to provide continuous updates until the Final Completion Record Set is reviewed and approved by the Owner, A/E, and CxA.

3.3 MILESTONE SUBMITTAL: FINAL COMPLETION SET:

- A. The Contractor shall provide complete updates to the Substantial Completion Draft documentation, for all electronic and print media.
- B. The purpose of this submittal is to provide the final O&M documentation for closeout of the Contractor's contract and to provide the Owner with a final Record Set for the project.

END OF SECTION

SECTION 017823.11 – FM DATA REQUIREMENTS FOR O&M

PART 1 - GENERAL

1.1 SUMMARY

A. Description:

1. This section specifies the standards that the Contractor shall follow for their scope of work related to Facilities Management Data (FM Data) Requirements. This section also includes information related to documents that are required for operations and maintenance support functions.
2. This section does not negate any other section that requires Commissioning or Operations and Maintenance Data.
3. Part 3 includes information about owner provided tools for managing the facilities management data and documents.

B. Related Sections:

1. Section 01 77 00 – Closeout Procedures
2. Section 01 91 00 - General Commissioning Requirements

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. Facility Equipment Information

1. **Content:** The Contractor will provide facilities information, that is:
 - a. Contact Information (email, company name, website, phone number) per the following:
 - i. general contractor(s)
 - ii. sub-contractors installing products from 'equipment information' section
 - iii. manufacturers providing equipment from 'equipment information' section
 - iv. Example: info@trane.com, Trane, trane.com, 999.999.9999
 - b. Space Information (Provided by Architect):
 - i. room number, room name, floor number, ceiling height, associated floor plans (Mechanical ductwork and piping, Plumbing, Electrical power)
 1. Example: M107, Main Mechanical Room, 01, 16', M-102A, M202-A, P-102A, E-102A
2. The drawings to be cross-referenced shall be the original

contracted(awarded) drawings. If “as-builts” are produced at the end of the project, the updated drawings shall be substituted for the original drawings.

c. Equipment Information

i. Construction Start Data (Provided by Architect):

- a. General: equipment name (from plans), equipment location (room number), equipment description (with specific location as applicable), asset group. Example: a) AHU-1, M107, Air Handler, AHU
- b. Parent: Identify parent (upstream) component equipment as applicable. Parent / child relationships between equipment are critical to operational effectiveness after transition to operations. This information is used in the operational systems by the owner's facilities management organization.
 - a. ELEC: this should indicate the electrical panel feeding power to the component (asset / piece of equipment).
 - i. Example: for AHU-1, the electrical parent is Panel N1L1 (AHU-1 is powered from Panel N1L1)
 - b. HVAC: This shall indicate the mechanical equipment connections to the component (asset / piece of equipment)
 - i. Example: for AHU-1, the parent is “N/A”
Example: for VAV-1, the parent is “AHU-1”
- c. Support Locations: Support locations are the spaces (room numbers) that are impacted by (or supported by) equipment. This information could be limited to one room or multiple rooms. This information aids the operation team after transition to operations by knowing what spaces are affected by equipment that needs to be isolated (shut down) for various reasons. This information shall be provided for all HVAC terminal devices, such as Fan Coil Units and Fan Powered VAV boxes.

ii. Submittal Data:

- 1. General: installer, manufacturer, model, approximate cost, expected life, warranty d. ration, associated approved submittal
 - a. Example: HVAC Installers, Trane, C1000, \$125,000, 30 years, 5 years, 23 00 10 - Air Handlers.pdf
 - b. This is information that will be added to the FM data once submittals are approved and specific equipment information has been determined.
- 4. Specific Attributes: For a list of applicable attributes, see Table

02 - Equipment Attributes. Equipment attributes vary by equipment group (asset group).

- a. Example: air filter: 36"x36"x2" pleated, belt: 24" v notch
 - b. Examples of possible attributes are:
 - i. filter: type (oil, water, air) & size
 - iii. Install Data: serial number, name plate photo, equipment photo
 - 1. Example: 100045312, AHU1-nameplate.jpg, AHU1.jpg
 - 2. This information can only be gathered once the equipment has been properly installed in the field. Photos should be taken of the equipment in the final installed condition (not in-process condition); however, the team shall collaborate with the owner on desired expectations prior to taking photos.
 - iv. Close-Out Data: associated commissioning report, associated O&M document, associated warranty document in PDF format
 - 1. ex: CX-AHU1.pdf, OM-AHU1.pdf, WarrantyAHUs.pdf
 - d. Referenced Documents:
 - i. Associated electronic files of referenced documents from 'space information' and 'equipment information'.
 - ii. Names of electronic files shall match what is referenced in the appropriate fields for document name. This specification does not prescribe a document nomenclature; however, it is expected that owner requirements detailing file naming are used with all referenced documents required in this specification.
2. **Deliverable Format:** The Contractor will provide facilities information, per the following:
- a. Contact, space, and equipment information shall be provided in spreadsheet format (XLSX, XSL, or CSV) and be an as-built representation.
 - b. Referenced documents shall be provided in electronic format and organized per the following:
 - i. Parent folder named by building number and year of substantial completion. (Example: 1416-2013)
 - ii. Sub-folders named by document type (Submittals, O&Ms, Cx, Drawings, As- Builts, Warranties)

3. **Schedule for Data Development:**

The Contractor shall provide equipment information throughout the project as the information becomes available and approved for use. As seen in a previous section (equipment information), each set of fields are named to indicate the expected phase the data is to be provided. They include: 1) construction start, 2) submittal, 3) install, and 4) close-out.

The first set of fields will be those data points that are provided by the Contractor at construction start. The second set of fields will be those data points that are to be provided by the Contractor during the submittals stage. The third set of fields will be those data points that are to be provided by the Contractor during the install / inspection stage. The last (fourth) set of fields will be those data points that are to be provided by the Contractor during the close-out stage.

Reasonable milestone dates for each of the four data deliverable phases shall be provided by the Contractor for approval by the Owner at construction start. It is understood that some information may lag in the development cycle for construction, such as the completion of all submittals. The intent is for the Contractor to make reasonable progress on the FM Data deliverables over the duration of the construction effort and not to defer the effort until the final months of the project. The entirety of the final data is to be completed within two weeks after substantial completion.

4. **Final Deliverable:** The Contractor shall provide final deliverables to the owner within two (2) weeks of the substantial completion date. Deliverable data shall match what is within the web-based tool (the source), and shall be in spreadsheet format (XLS) along with zipped folder of all associated reference files exported from that web-based tool. Format of deliverables, content, and schedule are addressed in other parts of this specification section.

PART 3 - EXECUTION

3.1 Process

A. Submission and Review of Facilities Management Data (FM Data)

- a. The Contractor shall provide the required data fields at the end of each major phase of construction as indicated in the schedule section above and per the related milestone dates approved by the owner.
- b. Data shall be submitted (made available) to owner at the agreed upon milestone dates for review purposes. The owner will review data for accuracy with documents and field conditions by various means.
- c. Following review at various stages, the Owner shall provide the Contractor with an Issue Report. Issue Reports will contain any discovered deviations from field conditions or inaccuracies of facilities data. Any identified deviations from field conditions (issues) will require the Contractor to correct and resubmit the data within two (2) weeks of receiving the issue report.

SECTION 017836 - WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the following General Conditions for terms of the Contractor's warranty of Work.
 - a. If there is any discrepancy in the Contract Documents regarding the warranty period or its date of commencement, the specified passage granting the Owner the longest warranty period ending on the latest date shall govern.
 - 2. General closeout requirements are included in Section 01 77 00 "Closeout Procedures."
 - 3. Specific requirements for warranties for the Work and products and installation that are specified to be warranted are included in the individual sections of the Specifications.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Related Sections
 - 1. Section 01 77 00 – Closeout Procedures
 - 2. Section 01 78 23 – Operation and Maintenance Data
 - 3. Section 01 78 23.11- Facilities Management Data Requirements for Operations Maintenance
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors that are required to countersign special warranties with the Contractor.

1.2 DEFINITIONS

- A. "Standard Product Warranties" are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. "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.

1.3 WARRANTY REQUIREMENTS

- A. General: Upon determination that Work covered by a warranty has failed, correct or replace the Work to an acceptable condition complying with requirements of Contract Documents.

- B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected or replaced and retested and/or re-commissioned reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- D. Costs: The Contractor is responsible for the cost of correcting or replacing including the cost for retesting and/or re-commissioning defective Work, regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- E. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
 - 2. Right to Refuse Work: The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

- A. Submit written warranties to the Owner's Representative in the form of a Warranties and Bonds Manual (refer to specification section 01 77 00 – "Closeout Procedures"). Provide a draft for Owner's review, as required in section 01 77 00 relating to O&M submittals.
- B. Provide a warranty claim procedure summary page that includes the contact information and procedures for Owner's use in making a warranty claim.
- C. Provide a warranty summary page that includes a spreadsheet of the following items:
 - 1. A list of all warranties provided for the project,
 - 2. The name of the warranty (or a brief description of the warranted items),
 - 3. The specification reference (or other reference) stating the warranty,
 - 4. The start date of the warranty,
 - 5. The end date of the warranty,
 - 6. The name and contact information of the installing Contractor/Vendor pertaining to the warranted item(s), as well as the associated major subcontractor that the installing Contractor/Vendor worked under.
- D. Warranties shall identify:
 - 1. Scope description of what is covered (indicate labor and/or materials requirements);

2. The Specification reference stating the warranty;
 3. The date of the warranty's start and finish (indicate the specified warranty duration);
 4. Service and maintenance contracts, when specified in the Contract Documents;
 5. Supplier's name, address, e-mail address, and telephone number;
 6. Proper procedure in case of failure; and
 7. Instances and operational conditions that will affect the validity of warranty or the ability of the Owner to make a warranty claim.
- E. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties.
1. Refer to individual sections of the Specifications for specific content requirements, and particular requirements for submittal of special warranties.
- F. Include the Warranties and Bonds Manual in the Operations and Maintenance (O&M) documentation, including the electronic O&M (eO&M). Refer to specification section 01 78 23 – "Operation and Maintenance Data".
- G. Review and acceptance, by the A/E or Owner's Representative, of submitted warranties does not relieve the Contractor of the warranty requirements of the Contract Documents.
- H. The Owner may generate and keep electronic copies of original executed warranties, certifications, and other similar commitments and such copies shall be considered as originals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Description: This section includes administrative and procedural requirements for providing demonstration and training to the Owner, as executed according to the Owner Training Plan, including the following:
 - 1. Deliverable format and content requirements for the Owner Training Plan,
 - 2. Procedural and content requirements for Owner training sessions,
 - 3. Deliverable requirements for video recording of Owner training sessions.
- B. Related Sections:
 - 1. Section 01 32 16 – Construction Progress Schedule
 - 2. Section 01 77 00 – Closeout Procedures
 - 3. Section 01 91 00 – General Commissioning Requirements

1.2 MANAGEMENT OF THE OWNER TRAINING PROCESS

- A. The Commissioning Authority (CxA) for the project will prepare the draft outline of the Owner Training Plan. This draft outline will include the training sessions required for the project, a sample training calendar, and a sample training session agenda template.
- B. The Contractor's Commissioning Manager (CxM) shall take over management and updating of the draft Owner Training Plan and fill in all information required to produce a complete and comprehensive document.
- C. The completed Owner Training Plan shall be submitted to the A/E, Owner, and CxA for review and approval. The Contractor shall incorporate all revisions per the review comments.
- D. After the Owner Training Plan is approved, the Contractor shall continue to make updates and distribute the revised plan as changes occur.
- E. The CxM shall prepare a current, three-month look ahead Owner Training Calendar and distribute the document at all of the weekly commissioning meetings, as well as maintain a current electronic version on the project's website for electronic document postings.
- F. The CxM shall keep a current and complete version of the Owner Training Plan on site, in a location that is accessible by the CxA, Owner, and Contractor.
- G. The CxM shall provide notification of upcoming training sessions to the Owner and CxA and shall include the name of the training session, the date, the time, and the meeting location. The notifications shall be in two parts for each session:
 - 1. Part 1: The CxM shall, at the end of each work week, send notification of all upcoming training sessions for the preceding week.

2. Part 2: The CxM shall send notification of each upcoming training session on the morning of the day before it occurs.
- H. During the training session, the Contractor shall provide one hard copy of the latest electronic Operation & Maintenance documentation (eO&M) pertaining to the training topic. This documentation shall be used as a training reference and shall be available for review by all participants.
- I. The Owner training sessions will consist of several types of sessions, as follows:
 1. Contractor/Vendor Training Sessions: These training sessions will be performed by the Contractor, typically utilizing the vendor or installing subcontractor who has sufficient qualifications to provide the training. The Contractor shall prepare training agendas ahead of time, based on the training agenda templates.
 2. Video Instructions: The Contractor shall provide training videos for the Owner's future reference and instruction. The video training shall be provided in two parts, in accordance with the following:
 - a. The Contractor shall utilize the services of a videographer experienced in producing training videos for construction projects. The videographer shall record the training and demonstration sessions presented to the Owner.
 - b. Where the manufacturer has standard training videos and will allow the Owner to copy the videos for Owner's use, the Contractor shall obtain those training videos and convert them to the video electronic file format being used for the rest of the video training materials.

1.3 TRAINING INSTRUCTORS QUALIFICATIONS

- A. For each training session, the Contractor shall provide training instructors who are both knowledgeable in the technical aspects of the equipment/system as well as the project specifics, including how the equipment/system relates to the project.
- B. The Contractor shall provide more than one instructor in cases where one instructor does not have both the technical expertise of the equipment/system and the familiarity with the project and how the equipment/system relates to the project.
- C. The instructors shall have the ability to speak clearly and in an organized manner to maximize the effectiveness of the training.
- D. The instructors shall tailor the training agenda to meet the technical aptitude and relevance of training materials for the audience in attendance.
- E. The instructors shall use the latest version of the electronic Operations and Maintenance (eO&M) documentation as a reference tool for the instructional training materials. This presentation of the eO&M documentation will also serve as an introduction of the O&M documentation that will be available to the Owner for that particular subject.

1.4 TRAINING VIDEO SUBMITTAL SCHEDULE

- A. The training videos shall be available for Owner's use, within the eO&M document, no less than 14 calendar days prior to the turnover of building operations from the Contractor to the Owner.

PART 2 - PRODUCTS

2.1 OWNER TRAINING PLAN

- A. The Contractor shall develop a complete Owner Training Plan, based on the template document provided to them from the CxA.
- B. The plan shall contain the following elements:
 - 1. Training Matrix:
 - a. Provide a single spreadsheet document containing a summary of the training sessions to be conducted,
 - b. List of training sessions required,
 - c. Brief description of training session topic(s),
 - d. Name of instructor(s) and employee(s),
 - e. Owner's intended audience of the session.
 - 2. Training Sessions Calendar:
 - a. Provide a series of calendar pages with one month indicated per page,
 - b. Individual training sessions listed on the day it occurs including the name of the session, the start time, the meeting location, and the expected duration.
 - 3. Training Session Agendas:
 - a. Provide separate training agendas for each training session including the following:
 - 1) Attendance sign-in sheet
 - 2) Name of project,
 - 3) Title of training session,
 - 4) Instructor's name(s), title(s), and company(ies),
 - 5) Name of installing contractor,
 - 6) Itinerary for topics to be covered in the classroom setting,
 - 7) Site walk.
 - b. The itinerary of topics to be covered shall include the following, but may be altered during the review process of the Owner Training Plan:
 - 1) Introduction of instructor(s),
 - 2) Contact information for service,
 - 3) Warranty information including warranty expiration dates (both the manufacturer's warranty as well as the additional warranty requirements of the contract documents) and any requirements to maintain the warranties,
 - 4) Basic description of the topic and how it relates to the facility (description of the equipment/system, purpose, location/service access, what it serves, and basic operation),
 - 5) Any special or unique features of the equipment/system,
 - 6) Log-in procedures to equipment/system controls and monitoring interfaces,
 - 7) Setup procedures including review of programmed parameters (where applicable) and calibration processes. The Contractor shall provide one copy of the startup documentation (when startup documentation is required to be provided) for review by the audience during the training session,
 - 8) Equipment/system startup procedures (using eO&M documentation as a reference),
 - 9) Normal operation mode procedures (using eO&M documentation as a reference),
 - 10) Equipment/system shutdown procedures (using eO&M documentation as a reference),
 - 11) Emergency condition procedures (for each emergency situation),
 - 12) Expected restart response of equipment/system after a loss of electrical power event as well as restoration of electrical power event,

- 13) Expected response to a building fire alarm event or other fire alarm system action,
- 14) Interfaces of the equipment/system to other building equipment/systems,
- 15) Preventative maintenance procedures (using eO&M documentation as a reference),
- 16) Operational troubleshooting procedures (using eO&M as a reference),
- 17) Safety precautions,
- 18) Regulatory requirements,
- 19) Instruction for proprietary tools, instruments, or software,
- 20) Recommended spare parts,
- 21) Intermissions,
- 22) Job site walk-through,
- 23) Questions and answer period.

2.2 TRAINING VIDEOS

- A. The Contractor shall include all training videos in the appropriate section of the electronic Operation and Maintenance (eO&M) document by inserting the electronic training video file into the appropriate file folder of the eO&M and creating a link to each video according that automatically starts the video playback. Coordinate with the Owner as to the video playback software and video file types that will be available for launching and playing the video from the eO&M document.
- B. Manufacturer's/Vendor's Training Videos:
 1. If training videos are available from the manufacturer or vendor, the Contractor shall obtain those videos and provide the video materials in the standard electronic video file format for the eO&M's.
 2. The Contractor shall first confirm with the manufacturer, and obtain written permission from them, that the video materials can be copied for use by the Owner without infringing on any intellectual property protections for the materials.
- C. Contractor's Video Recording of Owner Training and Demonstration Sessions:
 1. The Contractor shall use the services of a videographer to video record the instructional training and demonstrations required for the project.
 2. The videographer shall have the following minimum qualifications and capabilities:
 - a. The videographer shall provide all equipment necessary to produce high quality training videos including, but not limited to
 - 1) High resolution video camera(s),
 - 2) Tripods and other equipment/methods necessary to produce stable video recording images,
 - 3) High quality microphones, including a wireless, clip-on microphone for the instructor's use as well as boom-type microphone to capture the other audio within the room.
 - 4) Appropriate software to edit, organize, and convert videos to the required electronic video file format,
 3. The training videos shall be edited to follow a similar organized flow of content and shall include the following elements:
 - a. The training instructors shall start each video session with a similar introduction including statement of the project name, topic of the training session, name of the instructor, name of the instructor's company, and contact information for

- obtaining service for the equipment/system (name of service company, location of service company, and phone number for service calls),
 - b. Edited video recording of the Owner training and demonstration session,
 - c. Edited video recording of the question and answer period for the training session,
 - d. Edited video recording of the site walk portion of the training session,
 - e. Video recording of the specific equipment and identification of specific components, by the training instructor, to orient the viewer regarding what the equipment looks like in its installed condition as well as identification of the equipment's major elements.
- 4. The training videos shall be edited by the videographer to provide a smooth flow of the video presentation as well as to edit out extraneous materials, for example the recording of the transit of participants during the site walk, or other materials that would not be appropriate to include or do not add value to the final video product.
 - 5. If the Instructor does not have full knowledge of the project or how the equipment fits into the building systems, the Contractor shall provide personnel who have expert knowledge regarding the equipment and the project, to assist the instructor and the videographer in the recording phase. This person will act as a liaison between the instructor and the videographer to ensure that the training instructor provides a comprehensive training presentation, including nuances of how the equipment fits into the project, and ensure that the videographer captures all of the content necessary to produce a comprehensive training video. This personnel shall also assist the videographer in the editing phase to provide technical knowledge, as necessary to ensure the accuracy of the video content.
 - 6. The Owner shall provide final review and approval of the training video materials. The Contractor shall edit and revise the content according to the Owner's review comments. The Owner reserves the right to reject the materials based on their opinion of poor video quality, poor audio quality, or insufficient training content.
 - 7. The Contractor shall provide the training videos in ".mp4" electronic file format in order to be compatible with the video playback software used by the Owner.

PART 3 - EXECUTION

3.1 OWNER TRAINING SCOPE

- A. The following Owner Training Sessions shall be provided by the Contractor:

See matrix on following sheet:

Training Session Description	Intended Audience	Design Consultant Overview Session					Video Record?
			Number of Sessions	Onsite Hours (each)	Offsite Hours (each)		
MECHANICAL							
Building Management System and Controls	WSMPD Operations	No	2	8	---	Yes	
Air Handling Units, Heat Pumps, VFDs	WSMPD Operations	No	2	4	---	Yes	
ELECTRICAL							
Electrical Switch Gear and Controls	WSMPD Operations	No	1	2	---	Yes	
Interior and Exterior Lighting and Controls	WSMPD Operations	No	1	2	---	Yes	
Fire Alarm System and Controls	WSMPD Operations	No	1	2	---	Yes	

- B. The hours listed in the table of training sessions above only include the minimum requirements for duration of training sessions to be provided by the instructors to the Owner. The Contractor shall also provide sufficient hours from the instructors and personnel with project expertise to provide coordination and assistance in production of the final training videos, including additional instructor and personnel with expertise hours as necessary to edit or provide revised content per the Owner's review comments.

END OF SECTION

SECTION 01 81 16 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Description of the Construction Indoor Air Quality (IAQ) Management Plan
 - 2. IAQ Construction Requirements
- B. Related sections:
 - 1. Section 01 35 15 – LEED Certification Procedures
 - 2. Section 01 33 00 – Submittal Procedures
 - 3. Section 01 77 00 – Closeout Procedures
 - 4. Division 09 – Finishes
 - 5. Division 15 – Mechanical
- C. Construction Indoor Air Quality Requirements:
 - 1. The Owner has set indoor air quality goals for job site operations on project, within the limits of the construction schedule, contract sum, and available materials, equipment, products and services. These goals include:
 - a. Protect workers on the site from undue health risks during construction.
 - b. Prevent residual problems with indoor air quality in the completed building.
- D. Drawings, the provisions of the Agreement, the General Conditions, and Division 1 specification sections apply to work of this Section.
- E. Substitutions: Substitutions will be considered only under the terms and conditions of Section 01 25 00.

1.2 REFERENCES

- A. *Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).*
- B. LEED Building Design & Construction New Construction v4 (LEED-NC v4) IEQ Credit Construction IAQ Management Plan
- C. LEED Reference Guide for Building Design & Construction v4 IEQ Credit, Construction IAQ Management Plan
- D. ASHRAE 52.2-2007 Air Filtration Standard
- E. California Department of Public Health (CDPH) Standard Method v1.1-2010:
https://www.cdph.ca.gov/programs/IAQ/Documents/cdph-iaq_standardmethod_v1_1_2010%20new1110.pdf

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 00 – Submittal Procedures.
- B. Within fourteen (14) days after receipt of Notice of Award and prior to beginning any work on the site, the Contractor shall develop and submit to the Owner for review a Construction Indoor Air Quality (IAQ) Management Plan.
- C. The IAQ Management Plan shall include measures that comply with the following:
 - 1. The five requirements of SMACNA *IAQ Guideline for Occupied Buildings under Construction, 2nd Edition 2007, Chapter 3*: HVAC protection, source control, pathway interruption, housekeeping, and scheduling and shall include:
 - a. List of IAQ protective measures to be instituted on the site:

- 1) HVAC system protection during construction.
 - 2) Source control through specification and installation of low-toxic or non-toxic materials.
 - 3) Pathway interruption to isolate work areas where emitting materials are being installed.
 - 4) Housekeeping to protect materials that are stored before installation and to avoid spreading contamination through the Project.
 - 5) Sequencing installation of materials to avoid contaminating absorptive materials during construction.
2. A no-smoking plan that prohibits the use of tobacco products inside the building(s) and within 24 feet (7.5 m) of the building entrances(s) during construction. Smoking products include combustion of cannabis / controlled substances and emissions produced by electronic smoking devices, in addition to tobacco smoke.
 3. Identify procedures for protecting stored and installed absorptive materials from moisture damage.
 4. Indicate whether air handlers will be operated during construction, and include provision of appropriate filtration per this Section for any permanent equipment that will be used.
 5. Post-construction indoor air management requirements for the flush-out of the building, including scheduled dates for the flush-out, expected duration, and temperature and humidity monitoring methods.
- D. Schedule for inspection and maintenance of IAQ measures.
- E. Flush-out Report: provide flush-out dates, temperature and humidity ranges, and monitoring protocol.
- F. Air testing Report: provide an air testing report, highlighting the following:
1. Test dates
 2. Concentration of formaldehyde, particulates (PM 10 or PM 2.5, as applicable), total volatile organic compounds (TVOC), target chemicals from CDPH Standard Method v1.1-2010, and carbon monoxide (CO).
 3. Concentrations of the contaminants listed in 3.12 AIR TESTING.
 4. Test methods and any modifications made to the test methods. Explain how modifications, if any, assume that similar or better data are obtained.

PART 2 - PRODUCTS

- 2.1 Low-emitting product requirements are included in Section 01 35 15. Where low-emitting products have been specified in appropriate sections, Contractor to confirm compliance and provide relevant submittals per Section 01 35 15.
- 2.2 Permanent filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-2007
 1. For air intakes into rooms that are very sensitive to dust contamination, such as computer rooms, filtration media should be the best that the HVAC systems fans can handle, up to an MERV rating of 17.
- 2.3 If air handlers must be used during construction, temporary filtration media with a Minimum Efficiency Reporting Value (MERV) of 8, as determined by ASHRAE 52.2-2007, must be used at each return air grille.
 1. For air intakes into rooms that are very sensitive to dust contamination, such as computer rooms, filtration media should be the best that the HVAC systems fans can handle, up to an MERV rating of 17.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Implement IAQ management plan before starting above-ground construction, storing materials on-site, or roughing in mechanical systems.
- B. Photograph IAQ measures regularly and provide annotations of measures documented.

- C. Use safety meetings, signage, and subcontractor agreements to communicate the goals of the construction indoor air quality management construction plan.
- D. Post a copy of the IAQ management plan on site, preferably posted in an accessible area, and translated into the language(s) spoken by subcontractors and their crew.
- E. Conduct regular inspection and maintenance of indoor air quality measures including ventilation system protection, and ventilation rate.
- F. Heat, dehumidify, and ventilate building during course of Work. Maintain environmental conditions suitable for drying and curing materials and for prevention of conditions suitable for mold and mildew growth.
 - 1. Ventilate building to remove moisture, dust, fumes, and odors.
 - 2. Temper and dehumidify air to remove excess moisture.
 - 3. Do not use propane heaters and other moisture generating heating systems.
- G. Use low-toxic cleaning supplies for surfaces, equipment, and worker's personal use. Options include several soybean-based solvents and cleaning options and citrus-based cleaners. (SoySolv provides several soy-based solvents and cleaning options. Phone 1-800-231-4274 or www.soysoolv.com.)
- H. Smoking is prohibited inside the building once the building is closed in by any means or absorptive materials are located within the structure.

3.2 VENTILATION SYSTEM PROTECTION:

- A. Do not run HVAC system during course of construction without prior written approval of Owner or as otherwise permitted by these specifications. Seal ductwork intake and exhaust vents to prevent contamination from dust, moisture, and chemical contamination.
- B. Store HVAC equipment in a clean, dry location.
- C. Seal all HVAC inlets and outlets.
- D. Seal HVAC components during installation.
- E. Use a temporary ventilation system during construction.
- F. Use temporary filtration media.
 - 1. Temporary filtration media must be installed on any return air systems operational during construction.
 - 2. Replace all filtration media immediately prior to occupancy per **Section 23 41 00 Filters**.
 - 3. Replace all filtration media immediately prior to occupancy with filtration media per Products above.
- G. Clean air plenums before closing them in.
- H. Inspect filters regularly.

3.3 MICROBIAL AND FUNGAL CONTAMINATION PREVENTION

- A. Perform, schedule, and sequence Work as required to limit conditions supporting formations of microbes, molds, and fungi
 - 1. Ensure that construction detailing will not result in moisture intrusion.
 - 2. Protect on-site stored and installed absorptive materials (such as insulation, drywall, and wood) from moisture damage and from contamination by construction dust, debris, and fumes during all phases of construction, both before and after installation.
 - 3. Control water penetration, dampness, and humidity to protect products not treated for exterior use.
 - 4. Do not install moisture-damaged materials.
- B. When visible microbial, mold and fungal formations are observed, promptly contact Owner and Architect for determination by industrial hygienist employed by Owner.

1. Clean non-absorbent materials using low hazard cleaners accepted by Owner and Architect.
 2. Remove and replace affected materials that cannot be completely cleaned by non-abrasive surface treatments.
 3. Remove and replace affected materials identified as being food sources for microbes, molds, and fungi.
- C. Remove interior products and finishes, identified as food sources, that have absorbed sufficient moisture to become damp, and are not immediately made dry, whether or not microbial, mold, or fungal growth is observed. Include:
1. Gypsum board.
 2. Organic materials composed of cellulose fiber or paper.
 3. Materials containing sucrose or other binders and glues identified as supporting microbial growth.
 4. Fibrous insulation materials including duct liner, fiberglass insulation, and mineral fiber.
 5. Mechanical ductwork.
- D. Wood Lumber and Engineered Products:
1. Take remedial action to reduce moisture content of wood products measured by a moisture meter as exceeding 15 percent moisture content.
 2. Oriented strand board (OSB), is not accepted roof sheathing, floor sheathing, exterior wall sheathing, and other locations subject to water exposure during or after construction. Cross-strand veneer plywood is accepted, as specified by Section 061000.
 3. Remove wood and cellulose based products showing signs of mildew from construction site, including in-place construction not accepted by Owner's industrial hygienist.
- E. Promptly correct conditions supporting or subject to become an environment microbial, mold, and fungal growth.
1. Repair conditions leading to moisture condensation and water penetration.
 2. Do not permit conditions leading to standing water.

3.4 POLLUTION SOURCE CONTROL

- A. Use low-emitting products (specified in appropriate sections).
- B. Provide strategies to avoid tracking pollutants into the work areas.
- C. Because aerosol points are highly volatile and difficult to control, avoid use for large areas.
- D. Allow high-VOC materials to off-gas prior to installation. For example, all dry furnishing and materials (such as carpet, floor tile, acoustical tile, textiles, office furniture, wood shelving, etc.) shall be allowed to "air-out" in clean environments prior to installation in a building.
 1. Use the least amount of "wet" materials (such as adhesives, sealants, glazes, caulks, paints, etc.) during construction and product applications while still maintaining installation protocol required to meeting for manufacturer's warrantee requirements.

3.5 POLLUTANT PATHWAY INTERRUPTION

- A. Use an air barrier or pressure differential to isolate areas at different stages of completion.

3.6 HOUSEKEEPING

- A. Confine dust-generating activities and promptly clean up dust and other potential airborne contaminants as they are generated.
- B. Use wet sanding for gypsum board assemblies. Exception: Dry sanding allowed subject to owner approval of the following measures:
 1. Provide full isolation of space under finishing
 2. Install plastic protection sheeting to provide air sealing during sanding operations
 3. Close/seal all air system devices and ductwork
 4. Sequence construction work to prevent contamination of other spaces with gypsum dust
 5. Provide worker protection

- C. Keep work area dry and promptly clean up all spills.
- D. Keep containers of volatile liquids covered when not in use.
- E. Do not allow accumulations of sawdust, dust, rags, debris, and carbon-based materials and materials emitting fumes and odors to accumulate within concealed construction, including within stud spaces and wall cavities. Remove and clean prior to enclosing behind permanent construction.
- F. Vacuum carpet, upholstery, and other porous materials throughout building using a high-efficiency particulate arrestor HEPA filter vacuum cleaner just prior to Substantial Completion. Replace and dispose of vacuum bags when bag is half full.

3.7 SCHEDULING

- A. Account for curing time and off-gassing when scheduling construction activities.
- B. Enclose building, control humidity, ventilate, and make watertight prior to installing interior materials and finishes.
- C. Allow wet-spray cellulose to dry before covering.
- D. Allow furnishings and materials such as carpet, floor tile, acoustical tile, textiles, office furniture, and casework, to air out in clean environment prior to installation.
- E. Install porous materials only after closing in the building.
- F. Allow sufficient time for work generating significant moisture to dry and cure before installing absorbent materials such as carpet, acoustical material, textiles, and other material of type that may attract and retain moisture.
- G. Provide adequate ventilation during curing period.
 - 1. Provide supplemental (spot) ventilation for at least 72 hours after work is completed. Preferred HVAC system operation uses supply air fans and ducts only; exhaust provided through windows. Use exhaust fans to pull exhaust air from deep interior locations. Stair towers and other paths to exterior can be useful during this process.

3.8 REMEDIAL ACTION

- A. Promptly take action as necessary to inspect and remediate conditions suspected of supporting biological, particulate, and chemical indoor air pollution. Identify, stop, and repair causes of uncontrolled water penetration into building.
- B. Promptly notify and consult with Owner and Architect, prior to beginning removal material, where contamination by hazardous chemicals, microbes, and fungi is suspected.

3.9 COMMISSIONING

- A. Inspect ductwork for refuse, contaminants, moisture, and other foreign contamination prior to Commissioning. Notify Commissioning Agent of satisfactory inspection prior to beginning of Commissioning.

3.10 PRE-OCCUPANCY FLUSH-OUT

- A. After construction is complete, including installation of all interior finishes, movable furnishings, and major VOC punch list items, and prior to occupancy, perform flush-out of building:
 - 1. Install new permanent filtration media prior to beginning of flush-out
 - 2. Supply total air volume of 14,000 cu ft. of outdoor air per sq. ft. of floor area
 - 3. Maintain an internal building temperature of at least 60 degrees F and no higher than 90 degrees F
 - 4. Maintain an internal building relative humidity no higher than 60%

3.11 FLUSH-OUT DURING OCCUPANCY

- A. After construction is complete, including installation of all interior finishes, (provided by owner) movable furnishings, and major VOC punch list items, and prior to occupancy, perform flush-out of building:
 - 1. Prior to occupancy:
 - a. Supply total air volume of 3,500 cu ft. of outdoor air per sq. ft. of floor area
 - b. Maintain an internal building temperature of at least 60 degrees F and no higher than 90 degrees F
 - c. Maintain an internal building relative humidity no higher than 60%
 - 2. During each day of occupancy:
 - a. Ventilation must begin at least three hours prior to occupancy and continue during occupancy, until a total of 14,000 cu ft. of outdoor air per sq. sf has been delivered to the space.
 - b. Outdoor air just be delivered at a minimum rate of 0.30 cfm of outdoor air per sq. ft. or at the design minimum outdoor air rate, whichever is greater.

3.12 AIR TESTING

- A. After construction is complete, including installation of all interior finishes, (provided by Owner) movable furnishings, and major VOC punch list items, and prior to occupancy, perform flush-out of building.
 - 1. Perform indoor air testing for the following:
 - a. Formaldehyde
 - b. Particulates (PM10 or PM 2.5, as applicable)
 - c. TVOC
 - d. Target chemicals from CDPH Standard Method v1.1-2010
 - e. Carbon monoxide (CO)

END OF SECTION

SECTION – 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Owner will employ an independent Commissioning Authority. The Commissioning Authority is an independent and knowledgeable third party, hired to verify that the systems work as intended. The Commissioning Authority will inform the Owner and the Architect of the results of commissioning and provide recommendations for final acceptance of commissioned systems.
- B. Commissioning is the process to verify to the Owner that mechanical and electrical systems, as well as other special systems, function together properly to meet the facility performance requirements and design intent as described in the Contract Documents. The Contractor shall be responsible for participation in the commissioning process as outlined below, and in references and attachments throughout the Contract Documents. The Contractor shall furnish labor and materials sufficient to meet all requirements of building commissioning under this contract.
- C. The Commissioning Authority, acting on the behalf of the Owner, will be cognizant of the Owner's Facilities Staff's need to be informed and given the opportunity to participate actively in the commissioning process to ensure a complete, thorough turnover of systems once the project is complete. To this end, the Commissioning Authority will ensure that Facilities Personnel are informed of commissioning activity and schedule, and of any coordination issues, such as special testing procedures or opportunity for hands-on training during functional testing.
- D. The Commissioning Authority is not authorized to modify, add to, or revoke the requirements of the Contract Documents. A change in the work can only be made as provided in the General Conditions.
- E. Specification sections in Division 1 - General Requirements (019100); Division 22 Plumbing (220800 - Commissioning of Plumbing); Division 23 - Heating, Ventilating, and Air Conditioning (230800 - Cx of HVAC); and Division 26 - Electrical (260800 - Cx of Electrical); outline the specific commissioning responsibilities of each subcontractor for that division, and also obligate the Contractor to coordinate and manage the commissioning responsibilities of those subcontractors.

1.2 RELATED WORK

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the work of this section.
- B. General requirements for testing agencies as specified in the Division 1, "Section Quality Control Services."
- C. Applicable Divisions 3 through 8 sections identify requirement for building enclosure components, installation, testing and demonstration of performance.
- D. Applicable Divisions 22 and 23 sections identifying the requirements for plumbing and HVAC systems relating to the installation of mechanical equipment and systems, particularly with respect

to equipment and system testing, start-up and performance demonstration/observation. Coordinate with the work of Division 26.

- E. Applicable Division 26 sections specifying the requirements for materials and installation of electrical equipment and systems, particularly with respect to equipment and system testing, start-up and performance demonstration/observation. Coordinate with the work of Divisions 22 and 23.

1.3 TERMS

- A. Acceptable Performance: A component or system being able to meet specified design parameters under actual load, including satisfactory documented completion of all functional performance tests, control system trending, and resolution of outstanding issues.
- B. Commissioning Authority: An independent and knowledgeable third party hired to verify that the systems achieve acceptable performance.
- C. Commissioning Team: The term used to define the overall group associated with performing commissioning work, including designated representatives of the Owner, Facilities Staff, Design Professionals, Construction Team, and the Commissioning Authority.
- D. Construction Team: The term used to define the overall group responsible for performing the work to complete the work on the Contract Documents, including the Construction Manager, Contractor, the Mechanical Contractor and associated subcontractors, and the Electrical Contractor and associate's subcontractors.
- E. Design Intent: Documentation behind design decisions that were made to meet the Owner's project requirements. The design intent describes the systems, components, conditions and methods to provide a fully functioning building.
- F. Functional Performance Testing: Full range of checks, tests and demonstrations carried out to determine that all components, sub-systems, systems, and interfaces between the systems function in accordance with the Contract Documents. In this context, function includes all modes and sequences of control operation, all interlocks and conditional control responses, and all specified responses to abnormal emergency conditions.
- G. Owner Project Requirements (OPR): A document developed by the Owner, with help of the Commissioning Authority and Design Team. The OPR details the functional requirements of the project, and the expectations of the buildings use and operation as it relates to the systems being commissioned.

1.4 DUTIES OF CONTRACTOR

- A. Incorporate commissioning activities into the overall construction schedule.
- B. Coordinate participation of the Mechanical, Electrical, Controls, Security, Fire Alarm and TAB Contractors in the commissioning process.
- C. Collect and provide to the Commissioning Authority information requested for development of a complete commissioning plan, pre-functional test checklists, Commissioning Field Notebook, and functional test procedures.

- D. Review the commissioning plan, project communication reports and test results, and submit comments to the Commissioning Authority.
- E. Provide equipment submittals for systems to be commissioned to the Commissioning Authority.
- F. Manage, track and complete the Commissioning Field Notebook, including pre-functional test checklists and commissioning related specification requirements.
- G. Verify that coordination, installation, quality control, and final testing have been completed such that installed systems and equipment comply with construction documents.
- H. Provide Commissioning Authority with controls system wiring diagrams and narrative sequences of operation in time for use in preparing the functional test procedures.
- I. Participate in any efforts to finalize sequences of operations with Owner, Designers, and Commissioning Authority.
- J. In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.
- K. Participate in commissioning meetings with the Commissioning Authority.
- L. Provide preliminary TAB report, indicating all actual field values recorded, to the Commissioning Authority prior to initiation of functional testing. These reports shall be incorporated in the Commissioning Field Notebook.
- M. Issue a written notice of readiness for each system to Commissioning Authority upon completion of all systems work, start-up, and pre-functional test requirements by trade Contractors.
- N. Operate equipment and systems, as required, for functional performance testing. This includes, but is not limited to, manipulating the appropriate controls systems to achieve the expected response for the functional test procedure.
- O. Participate in the fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
- P. Submit complete operation and maintenance information, and as-built drawings to the Commissioning Authority for review.
- Q. Provide documentation of training for the systems specified.

1.5 DUTIES OF COMMISSIONING AUTHORITY

- A. Provide Contractor with expected durations of commissioning activities for inclusion in the construction schedule.
- B. Collect and review design intent from the Design Team.
- C. Review the Contract Documents.
- D. Develop the commissioning plan.
- E. Develop pre-functional test checklists for each piece of commissioned equipment.

- F. Develop the Commissioning Field Notebook for use by the Contractor. Provide supplemental documentation, as necessary, to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.
- G. Organize a commissioning kickoff meeting and present the commissioning plan to the Commissioning Team.
- H. Review the Contractor submittals relative to the systems to be commissioned.
- I. Perform construction installation inspections follow installation progress, and to verify system installation quality and readiness for testing.
- J. Observe the start-up activities and initial testing of equipment and systems, as required, and review Contractor start-up documentation.
- K. Develop functional test procedures from Contractor submittals, including designer-approved control documentation, and narrative sequences of operation and control diagrams.
- L. Direct and perform functional test with assistance from Contractor.
- M. Provide site observation, functional test and other project reports in a timely manner. Document inconsistencies or deficiencies in system operations and system compliance.
- N. Coordinate via the Architect participation of Owner's Personnel involved with equipment, component and systems performance verification, and participation in required training.
- O. Witness and verify satisfactory completion of equipment and component tests and systems and inter-systems functional performance tests.
- P. Maintain the commissioning deficiency log. Verify resolution of deficiencies identified through the commissioning process.
- Q. Analyze and compile trend log results from performance period activities.
- R. Verify training for commissioned equipment and systems is provided to the Owner.
- S. Review Contractor Operations & Maintenance Manuals for commissioned equipment and systems.
- T. Complete a commissioning report.

PART 2 - PRODUCTS

- A. Not used.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS

- A. Commissioning Schedule

1. Contractor to incorporate commissioning activities into the overall construction schedule. If construction is phased, commissioning activities are to be included in all phases of the schedule. The schedule defines the milestones and conditions that must be achieved before functional testing can commence. The schedule also includes the expected duration of the various tasks. The Commissioning Authority will provide the Contractor with expected durations of commissioning activities.
2. Commissioning activities to be included in the overall construction schedule include, but are not limited to:
 - a. Power installation complete
 - b. Equipment start-up
 - c. Pre-functional test checklist endorsement
 - d. Controls system checkout complete
 - e. Controls system fully operational
 - f. Testing, adjusting, and balancing
 - g. Functional performance testing
 - h. Performance period
 - i. Operations and Maintenance Manual review
 - j. Owner personnel training

B. Contract Document Review

1. The Commissioning Authority will collect and review design intent information from the designers and verify that it meets the Owner's project requirements. Design intent documentation will be used in conjunction with the Contract Documents to develop the commissioning plan, pre-functional tests, and functional performance tests.

C. Commissioning Plan

1. The Commissioning Authority will develop a commissioning plan for the project. The commissioning plan is a tool through which the commissioning process is described and incorporates the Owner, Designers, Contractor and Commissioning Authority's rolls relative to the commissioning process. The commissioning plan will include the following:
2. Purpose of commissioning.
 - a. Detail the commissioning process
 - b. Identify commissioning team members
 - c. Include a commissioning team organization chart
 - d. Define commissioning team member responsibilities
 - e. Describe pre-functional and functional test procedures
 - f. Outline systems to be commissioned
 - g. Provide the commissioning schedule

D. Pre-functional Test Checklists

1. The Commissioning Authority will develop pre-functional test checklists for each piece of commissioned equipment. The pre-functional test checklist will outline required steps for the Contractor to complete prior to functional testing. Pre-functional test checklists verify installation, start-up and operational assessments have been completed for the equipment.
2. Manufacturer start-up forms provided with pieces of equipment will be collected in addition to the pre-functional test checklists.

E. Commissioning Field Notebook

1. The Commissioning Authority will develop a Commissioning Field Notebook to be used and completed by the Contractor. The notebook will identify and track all pertinent commissioning documentation required during the installation, start-up, and checkout phases. The notebook will be maintained by the Contractor on-site and will be made available to all Subcontractors for their use. The notebook provides a central location for the Subcontractors and Commissioning Authority to identify, copy, and organize all pertinent commissioning information.
2. The Commissioning Field Notebook will contain:
 - a. Summary describing the notebook's contents and use
 - b. Commissioning plan for Contractor field reference
 - c. Tabs for each system, with copies of pre-functional and functional test check sheets for pieces of equipment identified as part of that system
 - d. Commissioning project communication reports, deficiency logs schedule information, or any other documentation provided by the Commissioning Authority

F. Commissioning Kickoff Meeting

1. The commissioning plan will be presented to the Commissioning Team during a commissioning kickoff meeting. The Commissioning Team will review the plan and provide comments to the Commissioning Authority. The Commissioning Authority will incorporate appropriate comments into the plan and a finalized commissioning plan will be distributed to the Commissioning Team.
2. The Commissioning Field Notebook will be presented to the Contractor during the commissioning kickoff meeting. Instruction for its use will be conveyed during the meeting.

G. Installation Inspections

1. During the course of construction, the Commissioning Authority will perform installation inspections for commissioned equipment and systems. Deficiencies will be noted and conveyed in project communication reports to the appropriate Commissioning Team members.

H. Pre-functional Test Checklist Completion

1. Using the pre-functional test checklists developed by the Commissioning Authority, the Contractor will verify that the systems they install are in compliance with the construction documents and are fully functional. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed, and returned to the Commissioning Authority indicating specific system completion.
2. Contractor will issue a written notice of readiness to the Commissioning Authority upon completion of all systems work, start-up and endorsement of pre-functional tests.

I. Contractor Submittal Review

1. In preparation for development of functional test procedures, the Commissioning Authority will review Contractor submittals for commissioned equipment and systems.
2. The Contractor will provide copies of the submittals for commissioned systems and equipment to the Commissioning Authority for use in development of functional test procedures. Submittals will be reviewed for conformity with the design intent.

J. Functional Test Procedures

1. The Commissioning Authority will develop functional test procedures for each piece of commissioned equipment. The functional tests outline the process for testing the building's systems. Functional tests verify the performance of equipment adhere to the design intent.
2. Functional test procedures include, but are not limited to, the following:
 - a. Verification of testing, adjusting and balancing performance
 - b. Verification of the performance of automatic controls in all seasonal modes
 - c. Verification of the performance of a HVAC system
 - d. Verification of the performance of electrical systems
 - e. Verification of the performance of plumbing systems
 - f. Verification of the performance of all life safety devices and systems as they interface with the HVAC systems
 - g. Verification of the response of automated controls to alarms, fire alarm input, and power failures
 - h. Verification of all security systems components and response
 - i. Verification of trending capabilities of the automated controls system
 - j. Verification of building enclosure performance

K. Functional Testing

1. Functional testing is intended to begin upon completion of a system. The Commissioning Authority will not begin the functional testing process until each system is complete and documented. Testing may proceed prior to the completion of systems and/or sub-systems if expediting this work is in the best interests of the Owner.
2. Functional testing is performed by the Contractor and witnessed by the Commissioning Authority to verify proper sequencing, operation, and performance of installed equipment and systems under realistic operating conditions. As tests are successfully completed, systems will be deemed acceptable by the Commissioning Authority.
3. The Contractor is responsible for coordinating participation of Commissioning Authority and Subcontractors in functional testing.
4. For security, fire alarm, theater sound and theater lighting systems, the installing contractor will be responsible for providing point-to-point documentation and functional test documentation. The Commissioning Authority will witness testing of these systems.

L. Commissioning Deficiency Log

1. When acceptable performance cannot be achieved by tested equipment and systems, the cause of the deficiency will be identified. Deficiencies will be collected and tracked in a commissioning deficiency log maintained by the Commissioning Authority.

M. Corrective Measures

1. If acceptable performance cannot be achieved by a piece of equipment or a system, and if the deficiency is caused by installation error by the Contractor, the necessary corrective measures shall be carried out by the Contractor. Once corrective measures have been completed, the equipment or system will be retested by the Commissioning Authority until acceptable performance is achieved.
2. The Contractor will be allowed one retest by the Commissioning Authority after initial testing of the equipment. If acceptable performance is not achieved after the initial retest, the Contractor shall be financially responsible at standard rates to reimburse the Owner's representatives for the additional time taken to resolve the deficiency.

N. Project Communication Reports

1. In addition to the pre-functional test checklists, functional test procedures and the commissioning deficiency log, project communication reports will be delivered for all other commissioning activities performed by the Commissioning Authority. Project communication reports will be issued to the Contractor and key members of the Commissioning Team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, installation deficiencies, and successful or unsuccessful functional testing results.

O. Commissioning Meetings

1. Commissioning meetings will be held periodically during the construction process to review the status of the construction and commissioning work, develop construction completion and testing schedules, and the status of submittals required by this section. Attendance by the Construction Team is required for commissioning meetings.
2. Commissioning meetings will be coordinated by the Contractor. Meeting minutes will be developed and maintained by the Commissioning Authority.

P. Performance Period

1. Upon successful completion of functional test procedures, a performance period of 15 consecutive calendar days shall commence on first day following the last performance test. This period shall be completed prior to final acceptance of the project. In event of failure to meet standard of performance during any initiated performance period, it is not required that one 15-calendar day period expire in order for another performance period to begin.
2. If equipment or system operate and demonstrate continuing compliance with specified requirements for period of 15 consecutive calendar days from commencement date of performance period, it shall be deemed to have met the standard of performance.
3. Equipment will not be accepted by the Owner and final payment will not be made by the Owner until acceptable performance is met.
4. Contractor shall provide Commissioning Authority with trend logs of the system performance for the control variables and setpoint in each control process in 15-minute time increments.
5. Owner personnel training systems shall be first tested as independent building systems followed by tests of systems tied into Owner's systems. Types of Owner's systems include, but are not limited to:
 - Chilled Beams
 - DDC
6. Campus automated controls systems: Upon Contractor's completion of the requirements of the commissioning plan, the successful completion of the performance period, and receipt of the required documentation, the Commissioning Authority shall provide the Owner with a statement of acceptable performance.

Q. Operations and Maintenance Manual Review

1. The Contractor shall assemble Operations & Maintenance Manuals as described in other sections of these Contract Documents.
2. The Commissioning Authority will review the Operations & Maintenance Manuals of commissioned systems and equipment once they have been reviewed and accepted by the Designer.

R. Training

1. A training plan will be developed by the Contractor outlining equipment that requires training, who will perform the training, when the training will occur, and the required duration of the training. Once the training plan is developed, the Owner will ensure that the appropriate personnel attend the training.
2. Training sessions should include using the Operations & Maintenance Manuals and as-built drawings assembled by the Contractor.
3. Detailed requirements for training and instruction are contained in other sections of these Contract Documents. The Commissioning Authority will track that training requirements have been satisfied by the Contractor.

S. Commissioning Report

1. Once acceptable performance is achieved, the Commissioning Authority will complete a commissioning report. The report shall include:
 - a. A commissioning activity executive summary.
 - b. The finalized commissioning plan.
 - c. The completed Commissioning Field Notebook, including pre-functional test checklists and specified commissioning related documentation.
 - d. Completed functional test procedures.
 - e. Commissioning project communication reports.
 - f. Up-to-date commissioning deficiency log.
 - g. Performance period trend log analyses.

3.2 SYSTEMS TO BE COMMISSIONED

- A. Systems and equipment to be functionally tested include, as described in Division 1 (019100), Division 22 (220800), Division 23 (230800) and Division 26 (260800).

END OF SECTION 01 91 00

SECTION – 03 30 00
CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, vapor retarders, waterstops, finishes, including stamping.
- B. Related Requirements:
 - 1. Section 033543 "Polished Concrete Finishing"
 - 2. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 3. Section 079200 "Joint Sealants" for sealants at traffic and non-traffic joints in concrete slabs.
 - 4. Section 071113 "Bituminous Waterproofing" for cold-applied cut-back-asphalt dampproofing at below-grade concrete walls.
 - 5. Section 099600 "High Performance Coatings" for anti-graffiti sealer applied to unit masonry assemblies and exposed, vertical concrete surfaces.
 - 6. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at remotely or at project site.
 - 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.
 - e. Special concrete finish 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, anchor rod and anchorage device installation tolerances, 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, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- E. Samples: For waterstops and vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Vapor retarders.
 - 8. Semirigid joint filler.
 - 9. Joint-filler strips.
 - 10. Repair materials.
 - 11. Concrete stamps
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

- C. Minutes of preinstallation conference.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 QUALITY ASSURANCE

- A. 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.
- B. 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."

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.10 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.

1.11 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water 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.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum. Used only at locations not exposed to view.
- D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: per structural drawings.

2.4 REINFORCEMENT ACCESSORIES

- A. Zinc Repair Material: ASTM A 780/A 780M.
- 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. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type II, gray.
 - 2. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S, Class 3M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4-inch nominal (typical). 1 1/2" aggregate is permissible at foundations only.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
- F. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- G. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. PVC or Rubber waterstops, contractor's option.
- B. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Profile: Flat dumbbell with center bulb.
 2. Dimensions: 6 inches by 3/8-inch thick (or as shown on drawings); non-tapered.
- C. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Profile: Flat dumbbell with center bulb.
 2. Dimensions: 6 inches by 3/8-inch thick (or as shown on drawings); non-tapered.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Acceptable manufacturer and product includes, but is not limited to:
1. Stego Wrap Vapor Barrier – 15 mils.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Curing and sealing compounds shall comply with 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."

2.9 CONCRETE STAMPS

- A. Concrete stamp set for imprinting an embossed repeating pattern into the concrete apron at main entry, see Civil drawings for extents.
 - 1. Basis of Design: Weatherwood Plank Concrete Stamp Set – 15 pc. (CON15-WWP). Contractor Source, LLC – 1246 Leah Road, Morris, IL 60450 – 1 (888) 263-5895. Installation per manufacturers written instruction.
 - 2. Equal products are acceptable with architect approval.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 .
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Combined Fly Pozzolan: 25 percent.
 - 2. Slag Cement: 50 percent.
 - 3. Combined Pozzolan and Slag Cement: 50 percent Portland cement minimum, with pozzolan not exceeding 25 percent.
 - 4. Combined Pozzolans and Silica Fume: 35 percent pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 5. Combined Pozzolans, Slag Cement, and Silica Fume: 50 percent with pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% of percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: Per structural drawings at 28 days.
 - 2. Maximum W/C Ratio: per structural drawings.
 - 3. Slump Limit: per concrete mix design .
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Foundation Walls: Normal-weight concrete.
 - 1. Minimum Compressive Strength: Per structural drawings at 28 days.
 - 2. Maximum W/C Ratio: per structural drawings
 - 3. Slump Limit: per concrete mix design.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: per structural drawings at 28 days.
 - 2. Maximum W/C Ratio: per structural drawings.
 - 3. Maximum Total Water Content: per structural drawings.
 - 4. Shrinkage Limits: per structural drawings

5. Slump Limit: per structural drawings plus or minus 1 ½" inch.
6. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size. Use at exposed polished concrete slabs.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
8. Finish of slabs to be exposed, see drawings: Polished or broom finished.
9. Finish of slabs to be exposed, see drawings: Troweled.

D. Building Walls: Normal-weight concrete.

1. Minimum Compressive Strength: Per structural drawings at 28 days.
2. Maximum W/C Ratio: per structural drawings.
3. Slump Limit: per concrete mix design.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch 3/4-inch nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 INTERIOR INSTALLATION

- A. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.2 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.

- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Do not chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEM INSTALLATION

- 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.

3.4 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints per structural drawings. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls per structural and architectural drawings. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas per structural drawings. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness 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 and time such that cutting action does not tear, abrade, or otherwise damage surface and is before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-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, per structural drawings.
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 Section 079200 "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.

3.8 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints per structural drawings. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 .
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations 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 lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Scream slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.
- 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.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. 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 uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view, to be covered with resilient flooring, carpet, or ceramic tile set over a cleavage membrane.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Unless otherwise noted: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17.
 - b. At polished concrete floors: specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere per architectural drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom. Refer to drawings for direction of broom finish. Verify texture of broom finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 6" high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: same as adjacent concrete slab at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor per structural drawings.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.

- b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
- 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 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 joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area 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.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas 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.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Headed bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. , but less than 25 cu. yd. , plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 - 6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .
 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 03 30 00

SECTION 033543 - POLISHED CONCRETE FINISHING

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 polished concrete finishing and scoring.
 - 1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."
- B. Related Requirements:
 - 1. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.
 - 2. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.
- C. LEED Requirements:
 - 1. General: This is a LEED affected Specification Section. Comply with all applicable LEED requirements as specified in this Project Manual, including the following:
 - a. 018113.13 – LEED Requirements.
 - 2. Required LEED Credits: As specified in Division 1 – 018113.13 – LEED Requirements and as indicated in "Apn-018113 – LEED Credit Matrix" document in the Appendix applicable to this Specification Section.
 - a. LEED Product Information Form: Submit the completed LEED Product Information Form in accordance with the template provided in the Appendix document "Apn-018113 – LEED Product Information Form".

1.3 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 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 polished 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. Cast-in-place concrete subcontractor.
 - e. Polished concrete finishing Subcontractor.
2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- C. Mock-up: Provide in-place mock-up to an area that will be covered by flooring. Illustrate varying grind and polish levels for owner's input and selection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
 - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove field sample panels when directed.

1.9 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
 - 1. Products: Subject to compliance with requirements, available manufacturers of products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Floor Products
 - b. ARDEX Americas
 - c. Euclid Chemical Company
 - d. L&M Construction Chemicals
 - e. PROSOCO, Inc.

2.2 SEALANTS

- A. Provide Sikaflex2c for sawcut or expansion joints at interior joints.
 - 1. Color: Dark gray or aluminum gray.

PART 3 - EXECUTION

3.1 POLISHING

- A. Polish: Level 3: High sheen, 800 grit. Medium aggregate exposure.
- B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
 - 1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
 - 2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
 - 3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
 - 4. Control and dispose of waste products produced by grinding and polishing operations.
 - 5. Neutralize and clean polished floor surfaces.

3.2 INSTALLATION

- A. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.
- B. Protect floor until substantial completion and neutralize and clean polished floor surfaces after back-punch has been completed.

END OF SECTION 033543

SECTION 042200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Related Requirements:

1. Section 099600 "High Performance Coatings" for anti-graffiti sealer applied to unit masonry assemblies.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

- C. Samples for Verification: For each type and color of the following:

1. Exposed Decorative CMUs.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.6 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:

1. Masonry units.

- a. Include data on material properties material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction typical exterior wall typical interior wall typical exterior and interior walls in sizes approximately 96 inches long by 64 inches high by full thickness, with a demarcation at 32" high between Type 1 and Type 2 CMU. Along the width of the panel, 1/3 to be finished with sealer, 1/3 to be finished with anti-graffiti coating, 1/3 to be left unfinished.
 2. Protect approved sample panels from the elements with weather-resistant membrane.
 3. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. 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.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. 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 of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. 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.
- D. 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 TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: As indicated on structural drawings.
 - 2. Density Classification: Normal weight unless otherwise indicated.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
 - 4. Type 1 CMU, where indicated on drawings
 - a. Basis of Design Product: Mutual Materials "Castle White". Equal products will be considered as substitutes with architect's approval.
 - b. Size: Nominal 4" x 8" x 16"
 - c. Texture: Ground Face
 - d. Layup: Running Bond
 - 5. Type 2 CMU, north and south faces of fireplace, see drawings
 - a. Basis of Design Product: Mutual Materials "Castle White". Equal products will be considered as substitutes with architect's approval.
 - b. Size: Nominal 4" x 8" x 8"
 - c. Texture: Ground Face
 - d. Layup: Stack Bond with Every Other Block inset by 1/2" for checkerboard effect
 - 6. Exposed Faces: Provide color and texture matching the CMU Types listed.
- C. Decorative CMUs: ASTM C90.
 - 1. Unit Compressive Strength: As indicated on the structural drawings.

2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
4. Pattern and Texture:
 - a. Matching CMU Types listed.
5. Colors: matching CMU Types listed.

2.5 MORTAR AND GROUT MATERIALS

- A. Requirements. Refer to notes on structural drawings.
- B. Portland Cement: ASTM C150/C150M, 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.
 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors.
 - b. Lanxess Corporation.
 - c. Solomon Colors, Inc.
- F. Aggregate for Mortar: ASTM C144.
 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.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Euclid Chemical Company (The); an RPM company.
- I. Water: Potable.

2.6 REINFORCEMENT

- A. Masonry-Joint Reinforcement, General: Per structural drawings.

2.7 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Stainless Steel Wire: ASTM A580/A580M, Type 316.
 - 2. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.
 - 3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
 - 2. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
- B. Flexible Flashing: Use 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.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.
 - 2) Carlisle Coatings & Waterproofing Inc.
 - 3) GCP Applied Technologies Inc.
 - 4) Heckmann Building Products, Inc.
 - 5) Polyguard Products, Inc.
 - 6) W.R. Meadows, Inc.
 - 7) Williams Products, Inc.
 - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 2. Where flashing is fully concealed, use flexible flashing.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
 - 2. Elastomeric Sealant: ASTM C920, chemically curing urethane polysulfide or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT 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 or grout.
 - 2. Use portland cement-lime or mortar unless otherwise indicated.
 - 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. Mortar for Unit Masonry: Per Structural drawings and specification. Provide the following types of mortar for applications stated unless another type is indicated
- C. Pigmented Mortar: Use colored cement product.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Mix to match Architect's sample.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Type 1 and Type 2 CMUs.
- E. Grout for Unit Masonry: Per structural drawings.

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 the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

- 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 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. 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.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. 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.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. 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.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For 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.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 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 running bond; do not use units with less-than-nominal 8-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. All CMU to be solid grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

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 control joints in concrete masonry as follows and where indicated on the drawings. :
 - 1. Install preformed control-joint gaskets designed to fit standard sash block. Add mortar sand to surface of sealant at joints to match adjacent joints.

3.7 FLASHING

- A. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.
- I. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

3.9 PARGING

- A. Parge exterior faces of below-grade masonry walls and interior walls attached to existing concrete wall, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

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 stone and nonmasonry 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 concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION - 05 12 00
STRUCTURAL STEEL FRAMING

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. Structural steel.
2. Field-installed shear connectors.
3. Grout.

B. Related Requirements:

1. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.
2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 055213 "Pipe and Tube Railings" for galvanized and stainless steel railings.
4. Section 071113 "Bituminous Waterproofing" for cold-applied cut-back-asphalt dampproofing at below-grade structural steel columns.
5. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of 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.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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 Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, and shop-painting applicators.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.
- F. Source quality-control reports.

1.8 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.9 QUALITY ASSURANCE

- A. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.

1.10 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 corrosion and deterioration.

1. 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.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: per structural drawings.
- B. Channels, Angles: per structural drawings.
- C. Plate and Bar: per structural drawings.
- D. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50
- E. Cold-Formed Hollow Structural Sections: per structural drawings.
- F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: per structural drawings.
- G. Steel Pipe: per structural drawings.
 1. Weight Class: per structural drawings.
 2. Finish: Black except where indicated to be galvanized.
- H. Steel Castings: per structural drawings.
- I. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: per structural drawings.
- B. High-Strength Bolts, Nuts, and Washers: per structural drawings.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
 1. Finish: Hot-dip zinc coating

2.3 PRIMER

- A. Primer for exposed to view structural steel: Comply with Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings."
- B. Primer for enclosed structural steel (not exposed to view): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. 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/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- 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 SSPC-SP 3, "Power Tool Cleaning."
- F. 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/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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.
 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Galvanized surfaces.
 5. Surfaces enclosed in construction.
- 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. Structural steel enclosed in construction: SSPC-SP 3, "Power Tool Cleaning."
 2. Structural steel exposed to view: SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 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.

2.8 GALVANIZING

- A. Where indicated, provide 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 and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M 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 are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M 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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. 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. Do not remove temporary shoring supporting composite deck construction 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 303 and AISC 360.
- B. Baseplates Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and 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.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. 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/D1.1M 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 type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 099123 "Interior Painting."
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."
- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.7 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 05 12 00

SECTION – 05 50 00
METAL FABRICATIONS

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:
 - a. Steel framing and supports for countertops.
 - b. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - c. Peeler pole banding.
 - d. Beam end protections and extensions.
 - e. Steel for gutter hanger supports
 - f. Cistern scupper channel and channel wall support.
- B. Related Sections:
 - a. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - b. Section 051200 "Structural Steel Framing."
 - c. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal fabrications related to gutters, downspouts, collection boxes and gutter supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - a. Paint products.
 - b. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - a. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Low-Emitting Materials Submittals:
 - 1) EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - c. Materials and Resources Submittals:
 - 1) MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - 3) MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - a. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - b. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - c. 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.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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 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.

2.2 FERROUS METALS.

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 , Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - a. Provide stainless-steel fasteners for fastening aluminum.
 - b. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A ; with hex nuts, ASTM A 563 ; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 ; with hex nuts, ASTM F 594 ; and, where indicated, flat washers; Alloy Group 2 .
- D. Lock Washers: Helical, spring type, ASME B18.21.1 .

- E. Anchors, General: Anchors capable of sustaining, 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.
- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; 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, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - A. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5, unless otherwise indicated.
 - B. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593 , and nuts, ASTM F 594 .

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting, "and Section 099600 "High-Performance Coatings."
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. 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.

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 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 with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.

- c. Remove welding flux immediately.
 - d. 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 or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners 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.
 - a. 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, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches 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.
 - a. Fabricate units from slotted channel framing where indicated.
 - b. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting, "and Section 099600 "High-Performance Coatings.

2.8 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.
 - a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

- C. Galvanize exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

2.9 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 no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 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.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - A. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - A. Shop prime with zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - a. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - c. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - d. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - A. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

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:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. 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 screws, 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 the following:
 - a. Extruded Aluminum: Two coats of clear lacquer.
- G. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

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.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 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.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural and non-structural framing
 - 2. Wood blocking and nailers.
 - 3. Plywood backing and wall panels.
- B. Related Requirements:
 - 1. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.
 - 2. Section 061600 "Sheathing"

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - c. EQ Credit Low Emitting Materials: Non-Structural Composite Wood: Documentation confirming the product has low formaldehyde emissions that meet the California Air Resource Board ATCM for formaldehyde requirements for ultra-

- low emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins, in accordance with Section 01 35 15, LEED Certification Procedures
- d. EQ Credit Low Emitting Materials: Structural Composite Wood: Documentation certifying composite wood products use moisture resistant adhesives meeting ASTM D2559 and have no surface treatments with added urea-formaldehyde resins or coatings. Provide certification of compliance with industry standards for that product type, in accordance with Section 01 35 15 – LEED Certification Procedures.
3. Materials and Resources Submittals:
- a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. 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, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

- C. Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 35 15 LEED Certification Procedures.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground and Use Category UC3b for exterior construction not in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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.
- 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, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply 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 Lumber and 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 beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Plywood backing panels where indicated

2.4 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. Dimension Lumber Items: As indicated in the structural drawings.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Northern species; No. 2 Common grade; NLGA.
 - 2. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
- D. 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.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
 - 1. Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 81 13.13 LEED Requirements

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
 - 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 .

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. Sort and select lumber so that natural characteristics do 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.
- G. Comply with AWP A 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.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

- J. Use steel common 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. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- K. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 WOOD BLOCKING, AND NAILER 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.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

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.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. If wood shows signs of mold, mold spots, or moisture damage, remove such materials and replace products with new materials.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 06 10 00

SECTION – 061316
POLE CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood poles as shown on the architectural drawings.

B. Related work described elsewhere:

1. Section 051200, Structural Steel Framing for supports and connections
2. Section 055000, Metal Fabrications for flashing
3. Section 061000, Rough Carpentry for Building Components
4. Section 099300, Stain and Transparent Finishes for Finish

1.2 SUBMITALS

A. Shop Drawings. Show layout and detail necessary for determining fit and placement of wood pole configurations, show relevant coordination of structural connections.

1.3 LEED SUBMITTALS

A. For components of this section submit the following in compliance with section 01 35 15 – LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Low Emitting Materials Submittals:
 - i. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - ii. EQ Credit Low Emitting Materials: Additional VOC Content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15- LEED Certification Procedures.
3. Materials and Resources Submittals:
 - i. MR Credit BPDO Sourcing of Raw Materials: Manufacturers documentation demonstrating product claims of extended producer responsibility program, recycled content, Biobased certification, or FSC certified wood in accordance with Section 01 35 15- LEED Certification Procedures.
 1. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.4 DELIVERY AND HANDLING

A. Contractor will make all reasonable efforts to handle the finished wood in such a manner as to protect and preserve the finished surfaces.

1.5 QUALITY ASSURANCE

- A. Heavy timber/Wood pole manufacturer shall have a minimum of (4) four years of documented experience in manufacturing of timberwork.
- B. Heavy timber/Wood pole erector shall have a minimum of (4) four years of documented experience in erection of heavy timberwork.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Wood Poles: Western Cedar wood poles of size as noted on the Drawings.
 - 1. +/- 8", 16", and 18" diameter, length per drawings – maximum taper of 1 inch per 10 feet of length and maximum sweep of 1 inch per 10 feet of length. Maximum of 6-10 knots per 8 lineal feet.

2.2 FABRICATION

- A. Wood poles to be hand peeled and pressured washed, lightly sanded – preserving the cambium layer. Knots kept intact to be sawn off minimum 1/2", maximum 1" from surface of cambium layer – sand lightly.
- B. Finish. Immediately after drying and initial sanding, all wood poles and wood rails to be finished with Sikkens Wood Preservative, or equal to control mildew, rot surface mold and Sapstain fungi.
- C. Accurately cut all wood members to provide good bearing.
- D. Apply connector plates and bolts per the Drawings.

2.3 INSTALLATION

- A. Handle wood with care in installation to avoid damage to wood or construction in place.
- B. Securely brace during installation in accordance with industry standards.
- C. Installation bracing shall hold timberwork straight, plumb, and in safe condition until connections are completed.
- D. Install all temporary and permanent bracing and permanently fasten all wood poles before application of any loads.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emission testing, and Submittal requirements for EQ credit Low-Emitting Materials as specified in Section 01 35 15 – LEED Certification Procedures.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 – Construction Waste Management.

END OF SECTION - 061316

SECTION 06 13 24 - STRUCTURAL GLUED-LAMINATED TIMBER

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.
- B. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Beams, girders, and purlins.

1.3 DEFINITIONS

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives with the grain of the laminations approximately parallel longitudinally.

1.4 ACTION SUBMITTALS

- A. Product Data: For glulam timber and accessories. Include installation instructions and data on lumber, adhesives, fabrication, treatment, and protection.
- B. Shop Drawings: Show layout of structural glulam timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.
- C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glulam timber, including treatment and finishing.
- D. Certificates of Conformance: Issued by a Qualified Inspection and Testing Agency indicating that glulam timbers comply with requirements of AITC A190.1.
- E. Wood Treatment Certificates: Signed by wood treater certifying that treatment processes comply with requirements.
- F. 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.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed structural glulam timber construction similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC-licensed firm, with a minimum of 5 years experience.
1. Factory mark each piece of structural glulam timber with AITC Quality Mark. Place mark on surfaces that will not be exposed in completed work.
- C. Quality Standard: Comply with AITC A190.1, "Structural Glued-Laminated Timber;" "Product Standard PS56, "Structural Glued-Laminated Timber;" and AITC 117, "Standard Specifications for Structural Glued-Laminated Timber of Softwood Species."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with provisions of AITC 111, "Recommended Practice for Protection of Structural Glued-Laminated Timber During Transit, Storage, and Erection."

- B. Individually wrap members with plastic-coated paper covering, with water-resistant seams, before shipping or exposing to outdoor conditions.
- C. Use padded, nonmarring slings when handling architectural grade members.
- D. Coordinate deliveries with the General Contractor's erection sequence.
- E. Store on level surface. Members shall be supported with blocking so spaced as to provide uniform and adequate support. Members shall be blocked well off the ground at a well-drained location.
- F. Do not overload the structure with stored units.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLULAM TIMBER FRAMING

- A. Species and Grades for Beams, Purlins, and Arches: Provide glulam members of the following species that comply with AITC 117, "Manufacturing," for the following combination symbol:
 - 1. Species and Combination Symbol: Douglas fir, 24FV4.
 - 2. Species and Combination Symbol: Douglas fir, 24FV8.
- B. Appearance Grade: Provide industrial appearance grade members complying with AITC 110.
- C. Preservative Treatment: Where preservative-treated glulams are indicated, pressure treat lumber before gluing according to AWPAC 28 for waterborne preservatives. After dressing and end cutting each member to final size and shape, apply a field-treatment preservative to comply with AWPAC M4 to surfaces cut to a depth of more than 1/16-inch.
 - 1. Use preservative solution without water repellents or other substances that might interfere with application of indicated finishes.
- D. Adhesive: Wet use-type complying with ASTM D 2559.
 - 1. Do not use melamine-urea-formaldehyde adhesives for preservative-treated structural glulam timber.
 - 2. Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 81 13.13 LEED Requirements
- E. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- F. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.
- G. Connectors, Anchors, and Accessories: Fabricate from structural steel shapes, plates, and bars complying with ASTM A 36; steel bars complying with ASTM A 575, Grade M 1020; and hot-rolled steel sheet complying with ASTM A 570, Grade 33.

2.2 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
- B. Camber: Fabricate horizontal and inclined members, units of less than 1:1 slope, with either circular or parabolic camber equal to 1/500 of span.
- C. End Cut Sealing: Immediately after end cutting each member to final length and after wood treatment (if any), apply a saturation coat of end sealer to ends and other crosscut surfaces, keeping surfaces flood-coated for not less than 10 minutes.
- D. Seal Coat: After fabricating and sanding each unit and end coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for treated wood where treatment included a water repellent.

2.3 FACTORY FINISHING

- A. Wiped Stain Finish: Manufacturer's standard, dry appearance, penetrating acrylic stain and sealer, oven-dried, and resistant to mildew and fungus.
 - 1. Provide color selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. General: Erect structural glulam timber framing true and plumb, with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - 1. Use padded slings and protect corners with wood blocking.
- B. Fit structural glulam timber framing by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.
 - 1. Use connectors as templates for drilling bolt holes.
 - 2. Machine sand exposed surfaces to remove planning or surfacing marks, finishing with No. 120 grit sandpaper.
 - 3. Coat crosscuts with end sealer.
 - 4. Where treated members must be cut during erection, apply a field treatment preservative to comply with AWPA M4.
- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

1. Where treated members must be cut during erection, apply a field treatment preservative to comply with AWPAC M4.
- D. Install steel connectors, anchors, and accessories as indicated.
- E. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glulam timber if repairs are not approved by Architect.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.4 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, soiling, and damage from work of other trades.
- B. Coordinate wrapping removal with finishing work specified in Division 09. Retain wrapping where it can serve as a painting shield.

END OF SECTION 06 13 24

SECTION 061516 - WOOD ROOF DECKING

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 solid-sawn wood roof decking
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for dimension lumber items associated with wood roof decking
 - 2. Section 099300 "Staining and Transparent Finishing"
 - 3. Section 074113.13 "Formed Metal Roof Panels."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: 24 inches (600 mm) long, showing the range of variation to be expected in appearance of wood roof decking.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - c. EQ Credit Low Emitting Materials: Non-Structural Composite Wood: Documentation confirming the product has low formaldehyde emissions that meet the California Air Resource Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins, in accordance with Section 01 35 15, LEED Certification Procedures.

- d. EQ Credit Low Emitting Materials: Structural Composite Wood: Documentation certifying composite wood products use moisture resistant adhesives meeting ASTM D2559 and have no surface treatments with added urea-formaldehyde resins or coatings. Provide certification of compliance with industry standards for that product type, in accordance with Section 01 35 15 – LEED Certification Procedures.
- 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of wood roof decking to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood roof decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

- A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

2.2 SOLID-SAWN WOOD ROOF DECKING

- A. Roof Decking Species: Douglas fir-larch or Douglas fir-larch (North).
- B. Roof Decking Nominal Size: Per structural drawings.
- C. Lay Up: Per structural drawings.
- D. Roof Decking Grade: Commercial Quality Decking.
- E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.

- F. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- G. Face Surface: Smooth
- H. Edge Pattern: Channel grooved

2.3 ACCESSORY MATERIALS

- A. Fasteners for Solid-Sawn Roof Decking: Provide fastener size and type as shown on structural drawings.
- B. Fastener Material: Stainless steel or galvanized, as shown on the structural drawings
- C. Penetrating Sealer: Clear sanding sealer complying with Section 099300 "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.
 - 1. Sealers shall have a VOC content of 350 g/L or less.
 - 2. Sealers shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 FABRICATION

- A. Shop Fabrication: Where preservative-treated roof decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
- B. Predrill roof decking for lateral spiking to adjacent units to comply with AITC 112.
- C. Seal Coat: After fabricating and surfacing roof decking, apply a saturation coat of penetrating sealer.
- D. Apply indicated finish materials to comply with Section 099300 "Staining and Transparent Finishing" in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and support framing in areas to receive wood roof decking for compliance with installation tolerances and other conditions affecting performance of wood roof decking.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. Install solid-sawn wood roof decking to comply structural drawings and AITC 112.
 - 1. Locate end joints for combination simple and two-span lay-up.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged roof decking if repairs are not approved by Architect.

3.4 PROTECTION

- A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 061516

SECTION – 061600
SHEATHING

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. Wall sheathing.
 - 2. Roof sheathing.
- B. Related Requirements:
 - 1. Section 072713 "Weather Resistant Barriers and Air Barriers" for water-resistive barrier applied over wall sheathing.
 - 2. Section 061000 "Rough Carpentry" for framing of exterior walls to receive sheathing.
 - 3. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.

- b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 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."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated on drawings.
- C. Factory mark panels to indicate compliance with applicable standard.

2.3 WALL SHEATHING

- A. Plywood Sheathing: Where required by structural drawings

2.4 ROOF SHEATHING

- A. Plywood Sheathing: Per structural drawings
 - 1. Span Rating: Per structural drawings
 - 2. Nominal Thickness: Per structural drawings.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Refer to structural drawings for fastener type(s), spacing, and penetration dimension.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 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. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- D. Use common wire 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. Install fasteners without splitting wood.
- E. Coordinate wall and roof 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.

- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. 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.
- H. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall Sheathing:
 - a. Fasten to wood framing as indicated on Structural Drawings
 - b. Space panels 1/8 inch apart at edges and ends.
 - 2. Roof/Ceiling Sheathing:
 - a. Fasten to wood framing as indicated on Structural Drawings
 - b. Space panels 1/8 inch apart at edges and ends.
 - c. Protect roof sheathing immediately from inclement weather
- C. Protect wood sheathing before and after installation. Coordinate installation of temporary roofing to prevent water from staining plywood or underlaying assemblies.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION - 061600

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

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:
 - A. Exterior "burnt" wood siding for transparent finish
 - B. Exterior "burnt" wood trim for transparent finish
- B. Related Requirements:
 - A. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - B. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.1 DEFINITIONS

- A. MDO: Plywood with a medium-density overlay on the face.
- B. PVC: Polyvinyl chloride.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - A. LEED Submittal Coversheet
 - a. Materials and Resources Submittals:
 - 1) MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer

responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- 3) MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - A. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - B. Provide for air circulation around stacks and under coverings.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - A. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - B. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.6 WARRANTY

- A. Manufacturer's Warranty for Engineered Wood Siding and Trim: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - A. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.

PART 2 - PRODUCTS

2.1 EXTERIOR "BURNT" WOOD SIDING FOR TRANSPARENT FINISH

- A. Basis of Design Supplier: Charwood by Montana Timber
- B. Basis of Design Product: Tiger Wood (Type 1 and 2) and Sage Wood (Type 3), Locations per Drawings
- C. Species: Cedar

- D. Grade: Select Tight Knot
- E. Moisture Content: Kild Dried to less than 15%
- F. Nominal Thickness = 3/4"
- G. Lengths: Random from 8' to 16'
- H. Siding Profile: Shiplap w/ 1/8" reveal
- I. Lay up: Herringbone per drawings
- J. Factory finish: All 6-surfaces w/ Aquafir factory-applied clear coat finish

2.2 EXTERIOR "BURNT" WOOD TRIM FOR TRANSPARENT FINISH

- A. Basis of Design Supplier: Same as siding
- B. Basis of Design Product: Same as siding
- C. Species: Same as siding
- D. Grade: Same as siding
- E. Moisture Content: Same as siding
- F. Nominal Thickness = 1 1/2"
- G. Lengths: Per drawings
- H. Factory finish: All 6-surfaces w/ Aquafir factory-applied clear coat finish

2.3 PRE-FORMED METAL TRIMS AND CORNERS FOR WOOD SIDING

- A. Basis-of-design supplier: Tamlyn, www.tamlyn.com
 - 1. Outside Corner: Per Drawings.
 - 2. Inside Corner: Per Drawings.
 - 3. Vertical Reveals: Per Drawings.
 - A. Finish for All: Dark Bronze Anodized

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
 - A. For face-fastening siding, provide ringed-shank siding nails, or as required by manufacturer.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

- C. Flashing: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
- D. Sealants: Latex, complying with ASTM C834 Type OP, Grade NF and applicable requirements in Section 07 92 00 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - A. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - A. Use concealed shims where necessary for alignment.
 - B. Scribe and cut exterior finish carpentry to fit adjoining work.
 - C. Refinish and seal cuts as recommended by manufacturer.
 - D. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - E. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
 - F. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install flat-grain lumber with bark side exposed to weather.

- B. Install cellular PVC trim to comply with manufacturer's written instructions.
- C. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
 - A. Use scarf joints for end-to-end joints.
 - B. Stagger end joints in adjacent and related members.
- D. Fit exterior joints to exclude water.
 - A. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
 - B. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- E. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 INSTALLATION OF SIDING

- A. Install siding to comply with manufacturer's written instructions and warranty requirements.
- B. Horizontal Lumber Siding:
 - A. Apply starter strip along bottom edge of sheathing or sill.
 - B. Install first course of siding, with lower edge at least 1/8 inch below starter strip and subsequent courses lapped 1 inch over course below.
 - a. Nail at each stud.
 - b. Do not allow nails to penetrate more than one thickness of siding.
 - C. Leave 1/8-inch gap at trim and corners unless otherwise recommended by manufacturer, and apply sealant.
 - D. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
 - E. Install prefabricated outside corners as recommended by manufacturer of siding materials.
- C. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.
- D. Finish: Factory Finish

3.6 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
 - A. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean exterior finish carpentry on exposed and semi-exposed surfaces.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

1.1 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - A. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - B. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 13

SECTION 062023 - INTERIOR FINISH CARPENTRY

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. Interior Trim
 - 2. Interior wood cladding.
 - 3. Interior site-built linear wood ceilings
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry"
 - 2. Section 062013 "Exterior Finish Carpentry"
 - 3. Section 064116 "Plastic Laminate Faced Cabinets"
 - 4. Section 099123 "Interior Painting" for priming and back-priming of interior finish carpentry.
 - 5. Section 099300 "Staining and Transparent Finishing."
 - 6. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. MDF: Medium-density fiberboard.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranty.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:

- a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - c. EQ Credit Low Emitting Materials: Non-Structural Composite Wood: Documentation confirming the product has low formaldehyde emissions that meet the California Air Resource Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins, in accordance with Section 01 35 15, LEED Certification Procedures
3. Materials and Resources Submittals:
- a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

- A. Manufacturer's Warranty for interior wood cladding: Manufacturer agrees to repair or replace columns that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Interior Wood Cladding: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
 - 1. Interior trim.
 - 2. Interior wood cladding.
- B. Certified Wood: The following wood products shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - 1. Interior trim.
 - 2. Interior wood cladding.
- C. Low-Emitting Materials: Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 35 15
- A. - LEED Certification Procedures.
- B. Lumber: DOC PS 20 and the following grading rules:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
 - 2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
 - 3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
 - 4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
 - 5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
 - 6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."
- C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- D. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

2.2 INTERIOR TRIM

- A. Lumber Trim for Clear Finish:
 - 1. Species and Grade: White Oak; WWPA.
 - 2. Maximum Moisture Content: 13 percent.
 - 3. Finger Jointing: Allowed.
 - 4. Face Surface: Surfaced (smooth).
 - 5. Finish: Clear Coat

2.3 INTERIOR WOOD CLADDING

- A. Anthology Woods; Pearly Oak Legacy Solid 5" / SLOFL-050-SRL-PO or approved equal.
 - 1. Manufacturers: Anthology Woods or approved equal.
 - 2. Thickness: 3/4"
 - 3. Finish: Class I.
 - 4. Surface-Burning Characteristics: As follows, tested according to ASTM E 84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 5. Face Surface: Smooth.

2.4 INTERIOR LINEAR WOOD CEILINGS

- A. Lumber Trim for Clear Finish:
 - 1. Species and Grade: White Oak; WWPA.
 - 2. Maximum Moisture Content: 13 percent.
 - 3. Finger Jointing: Allowed.
 - 4. Face Surface: Surfaced (smooth).
 - 5. Finish: Clear Coat

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Cladding Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.
 - 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
 - 1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - 1. Interior standing and running trim except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.
5. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 1. Install trim after gypsum-board joint finishing operations are completed.
 2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 CLADDING INSTALLATION

- A. Interior Wood Cladding: Install according to manufacturer's written recommendations. Leave gap at top, bottom, and openings per drawing details. Butt adjacent boards with moderate contact. Use fasteners with prefinished heads matching paneling color.
 1. Plaster or Gypsum-Board Substrate: Install per manufacturer's written instruction.
 2. Nailer Substrate: Install per manufacturer's written instruction.

3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semi-exposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.

- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 071113 - BITUMINOUS DAMPPROOFING

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. Cold-applied, cut-back-asphalt dampproofing.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete."
 - 2. Section 051200 "Structural Steel Framing."
 - 3. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application 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 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course and auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. 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. APOC, Inc.; a division of Gardner-Gibson.
 - 2. Brewer Company (The).
 - 3. Euclid Chemical Company (The); an RPM company.
 - 4. Henry Company.
 - 5. Malarkey Roofing Products.
 - 6. Meadows, W. R., Inc.
- B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or non-fibered.
- D. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.
- C. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.
- D. Protection Course: ASTM D 6506, 1/8-inch- (3-mm-) thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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 the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do **NOT** extend onto surfaces exposed to view when Project is completed.
- C. Where dampproofing below-grade portions of structural steel columns, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Do **NOT** extend onto surfaces exposed to view when Project is completed.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).

- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).

3.5 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Install protection course within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 071113

SECTION – 07 21 00
THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
 - 2. Mineral-wool board.
 - 3. Batt Insulation.
 - 4. Vapor Retarding Membrane for interior surface of exterior walls and as called for in drawings.
- B. Related Requirements:
 - 1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
 - 2. Section 072119 "Foamed in Place Insulation" for spray foam.
 - 3. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Written insulation schedule describing where each type of insulation will be used.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of

certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:
 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA or as feature of Specified Product

- A. Interior Insulation: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Extruded Polystyrene Foam-Plastic Board and Batt Insulation: Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Mineral-Wool Board: Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

- B. Extruded Polystyrene Board, ASTM C 578, Type VII 60-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Styrofoam Highload 60 or comparable product by one of the following:
 - a. Owens Corning.

2.3 MINERAL-WOOL BOARD

- A. Mineral-Wool Board, Type IVB, ASTM C 612.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ROXUL COMFORTBOARD 80 or comparable, approved product.
 - 2. Density: 8 lbs/ft³ minimum for direct through-attached p.t. wood nailers at continuous insulation.

2.4 BATT INSULATION

- A. Basis-of-Design Product: Subject to compliance with requirements, provide ROXUL COMFORTBATT or comparable approved product.

2.5 VAPOR RETARDING MEMBRANE

- A. Basis-of-Design product is CertainTeed MemBrain, or comparable, approved product
- B. Accessories: spray adhesives and tapes for vapor barrier continuity.

2.6 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-values shown on drawings.
- E. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line or to top of footing, whichever is less.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.5 INSTALLATION OF MINERAL-WOOL BOARD INSULATION

- A. Mineral-Wool Board Insulation: Install adhesive per manufacturer's written instructions and recommendations. Fit courses of insulation between any obstructions, with edges butted tightly in both directions. Press units firmly against substrates.

3.6 INSTALLATION OF BATT INSULATION

- A. Cavity-Wall Insulation. Install per manufacturer's written instructions and recommendations. Fit insulation tight to framing and other and obstructions. Press units firmly substrates.

3.7 INSTALLATION OF VAPOR RETARDING MEMBRANE

- A. Vapor Retarding Membrane. Install per manufacturer's written instructions and recommendations. Installation shall be continuous, full taped and sealed membrane. Seal to walls, floors, penetrations and other transitions to prevent vapor migration through the wall.

3.8 PROTECTION

- A. Protect installed insulation and vapor retarding membrane 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.
- B. Seal all punctures and discontinuities in vapor retarding membrane before installing interior finishes.

3.9 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 07 21 00

SECTION 072119 - FOAMED-IN-PLACE INSULATION

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. Closed-cell spray polyurethane foam for use at hollow steel sections that occur in exterior wall and roof assemblies.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.
 - 2. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop drawing: Highlighted plan showing extents of spray foam insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:

- a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F. Closed cell content shall be not less than 98% and vapor permeance of 1.70 perms at 2" thick.
- B.
 - 1. Basis of Design Product: BASF Spraytite 178 or an equal, approved product from the following manufacturers or others with equal products.
 - a. Owens Corning.
 - b. Dow Chemical Company.
 - 2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- F. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 072119

SECTION – 07 27 13
WEATHER RESISTANT BARRIERS AND AIR BARRIERS

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. Air barriers
 - 2. Weather resistant barriers
 - 3. Associated materials
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.
 - 2. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. Barrier Material: A primary element that provides a continuous barrier to the movement of air, moisture and vapor.
- B. Barrier Accessory: A transitional component of the barrier that provides continuity.
- C. Barrier Assembly: The collection of barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air, moisture and vapor movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier and weather resistant barrier requirements and installation, special details, mockups, air-leakage and bond testing, barrier protection, and work scheduling that covers barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air barrier and weather resistant barrier assemblies.
 1. Show locations and extent of barriers. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 2. Include details of interfaces with other materials that form part of air or weather resistant barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier and weather resistant barrier manufacturer, certifying compatibility of barriers and accessory materials with Project materials that connect to or that come in contact with barriers.
- C. Product Test Reports: For each barrier assembly, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For air barriers, weather resistant barriers and flexible flashing, from ICC-ES.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, weather resistant barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, foundation wall intersection, and typical window opening (head, jamb, sill)
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.
- B. Testing: barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
 1. Whole Building air leakage testing per ASTM E 779, as required by the Washington State Energy Code.
 2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion as recommended by air barrier manufacturer, but not less than 16 PSI. according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.
 3. Air tightness testing at Natatorium / Pool spaces: prior to installation of interior finishes to confirm airtightness.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.3 SELF-ADHERING SHEET AIR AND WATER BARRIER

- A. Fully Adhered Vapor Permeable Air and Water Barrier Membrane: self-adhering sheet barrier, formulated for application with primer that complies with VOC limits of authorities having jurisdiction and as required for LEED certification.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Sopraseal Stick VP w/ related fluid-applied flashings or equal product by one of the following:
 - a. WrapShield SA by VaproShield
 - b. VP160 by Henry.

2.4 LIQUID APPLIED SILYL-TERMINATED POLYETHER (STPE) POLYMER FLASHING – noted as LAF on drawings.

- A. Liquid Applied STPE flashing: moisture cure single-component elastomeric liquid-applied flashing, for use with vapor permeable WRB/AB.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Sopraseal Liquid Flashing by Soprema or equal product by one of the following:
 - b. Vapro Liquiflash by VaproShield
 - c. Henry Blueskin Air-Bloc LF

2.5 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

- D. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick, cross-laminated polyethylene film with release liner backing.
- E. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- I. Sprayed Polyurethane Foam Sealant: Refer to Section 072110 "Foamed-in-Place Insulation."
- J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."
- K. Butyl rubber, Flexible Flashing (noted as SAM and FFSAM on drawings): Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density aluminum foil to produce an overall thickness of not less than 0.030 inch .
- L. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- M. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application. Existing concrete wall substrate is

painted. Remove paint as necessary to meet WRB manufacturer requirements for surface preparation.

- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 AIR BARRIER INSTALLATION

- A. General: Install sheets and accessory materials according to air-barrier manufacturer's written instructions.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F , install self-adhering, air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F .
- B. Corners: Prepare, prime, and treat inside and outside corners according to manufacturer's written instructions.
 - 1. Install strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply and firmly adhere sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 - 2. Roll sheets firmly with a mechanical roller to enhance adhesion to substrate.
- F. Apply continuous sheets over strips bridging substrate cracks, construction, and contraction joints.

- G. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch-wide, strip. Maintain shingle lapping and pre-strip membrane as required to ensure shingle fashion laps at tie-ins and flashings.
- H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic. Seal all lap edges at horizontal surfaces such as window sills and wall ledges.
- I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
- J. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply liquid applied STPE flashing per manufacturer's written instructions.
- L. Unless otherwise shown, fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.
- M. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- N. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.
- P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.
- R. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 FLASHING INSTALLATION

- A. Apply flashing where indicated to comply with manufacturer's written instructions.
 - 1. Install Liquid Applied STPE flashing (noted as LAF on drawings) at Permeable Air and Water Barrier Membrane. See drawings.
 - 2. Prime substrates as recommended by flashing manufacturer.

3. 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.
4. Lap flashing over water-resistive barrier at bottom and sides of openings.
5. Lap water-resistive barrier over flashing at heads of openings.
6. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Site conditions for application temperature and dryness of substrates have been maintained.
 4. Maximum exposure time of materials to UV deterioration has not been exceeded.
 5. Surfaces have been primed.
 6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 7. Termination mastic has been applied on cut edges.
 8. Air barrier has been firmly adhered to substrate.
 9. Compatible materials have been used.
 10. Transitions at changes in direction and structural support at gaps have been provided.
 11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 12. All penetrations have been sealed.
- C. Tests: As determined by Owner's testing agency from among the tests noted in 1.8.B "Testing."
- D. Barriers will be considered defective if they do not pass tests and inspections.
 1. Apply additional barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient barrier components for retesting as specified above.
- E. Repair damage to barriers caused by testing; follow manufacturer's written instructions.

3.6 CLEANING AND PROTECTION

- A. Protect barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 1. Protect barriers from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace barrier or install additional, full-thickness, barrier application after repairing and preparing the overexposed membrane according to barrier manufacturer's written instructions.
 2. Protect barriers from contact with incompatible materials and sealants not approved by barrier manufacturer.

- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 07 27 13

SECTION 074113 - STANDING-SEAM METAL ROOF AND 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.
- B. Related Requirements:
 - 1. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section includes:
 - 1. Standing Seam Metal Roof Panel
 - 2. High-temp self-adhered membrane underlayment; adhered.
 - 3. Substrate Boards; mechanically fastened.
 - 4. Roof insulation; mechanically fastened.
 - 5. Air and Vapor Barrier/Temp Roof; adhered.
 - 6. Accessories

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review structural loading limitations of deck during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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 (1:10).
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.9 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.

1.10 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.

1.11 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 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: Two years 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: 30 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 1680 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: UL 90.
- D. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- F. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Seamed-Joint, Standing-Seam Metal Roof Panels (noted as Metal Roof and Metal Panel Roof on drawings): Formed with raised ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips

located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span, Span Seam or comparable product by one of the following:
 - a. Other manufacturer with equal product, finish and warranty
2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 22 ga.
 - b. Exterior Finish: Metallic fluoropolymer
 - c. Color: Zactique II.
3. Clips: Manufacturer's standard, to accommodate thermal movement.
 - a. Material: 22 ga., zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Joint Type: Standing seam
5. Panel Coverage: 16".
6. Panel Height: 2".
7. Panel Length: full length, no horizontal seams.

2.3 HIGH-TEMP SELF ADHERED UNDERLAYMENT

- A. Roofing Underlayment: High-temp self adhered roofing underlayment

1. Basis-of-Design Product: Grace Ice and Water Shield or approved equal.

2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Building Products; Dens Deck Prime with Eonic Technology or approved equal.

- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

- B. Polyisocyanurate Board Insulation: ASTM C 1289, felt or glass-Seaman's Corporation Fiber mat facer on both major surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation FiberTite FTR-Value or approved equal.
- C. Expanded Polystyrene Foam Board, mechanically fastened typical drawings for extents. 60-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Tapered Insulfoam EPS Boards, or similar by approved equal for use at tapered crickets and transitions, see roof plan for extents.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Insulation, Coverboard, and Roofing Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Basis-of-Design Product: Seaman's Corporation FiberTite CR-20 or approved equal.
- C. Cover Board: 1/2 inch thick
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Building Products; DensDeck Prime cover board or approved equal.

2.7 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation FiberTite VaporTite or approved equal. Product shall be listed as air and vapor barrier underlayment.
 2. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Provide primer when recommended by vapor-retarder manufacturer.

2.8 MISCELLANEOUS MATERIALS

- A. General: Provide installation accessories as required for complete roofing system and as recommended by roofing manufacturer, including but not necessarily limited to:
- 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 ridges, 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, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-(2400-mm-)long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.
- E. Downspouts: Unless otherwise noted, downspouts to be formed from same material as roof panels. Fabricate in 10-foot-(3-m-)long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. 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.
- H. Substrate Board Fasteners: Galvanized steel; plain or with factory-applied corrosion-resistant coating, with three inch metal disks. Size and type required for coverboard type and thickness and for deck type. Provide fasteners which meet requirements for pullout resistance.
- I. Preformed Pipe Boot Flashings: Molded from same material as flexible flashings. Provide stainless steel band clamp for top edge.
- J. Insulation Fasteners: Self-tapping screws and metal disks designed to withstand design loads.

2.9 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. 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.
- E. 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. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. 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 panel manufacturer for application, but not less than thickness of metal being secured.

2.10 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 unacceptable. 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. Steel Panels and Accessories:
 - 1. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF 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.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

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 primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive vapor retarders 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 ROOF 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. Refer to drawings for limitations on where screws are to be located.
 - 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:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

- 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. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 2. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. 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 will be permanently watertight and weather resistant.
 - 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 and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- F. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- G. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- H. Roof Curbs: Install flashing around bases where they meet metal roof panels. Solder stainless steel crickets up slope of curbs.
- I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 SUBSTRATE BOARD INSTALLATION

- A. Mechanically fastened. See drawings for location of fasteners relative to decking profile.
- B. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.5 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling. Adhere the entire sheet by roller pressure as required by roofing manufacturer.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

- A. Prior to installation of substrate boards, install acoustic insulation - specified and provided by Section 053100 "Steel Decking - in metal deck flutes.
- B. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- C. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Provide routed out channels at bottom of insulation for above-deck installation of conduits and electrical boxes. Refer to drawings for locations.
- 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.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- H. Adhered Insulation: Above natatorium environment and five feet beyond, see drawings for extents. Install each layer of insulation and adhere to substrate as follows:
 - 1. Insulation shall be adhered in ribbons (beads) of low-rise foam adhesive, spacing of which is per roofing manufacturer's requirements.
- I. Mechanically Fastened Insulation. At all roof areas except where adhered above natatorium environment and five feet beyond, see drawings for extents: Install each layer of insulation and

secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Global's "RoofNav" 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. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together.

1. Mechanically fastened except adhered above natatorium environment and five feet beyond, see drawings for extents.
2. Install cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 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. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 074113

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Formed roof-drainage sheet metal fabrications.
 - 2. Formed wall sheet metal fabrications.
 - 3. Formed equipment support flashing.
 - 4. Formed overhead-piping safety pans.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for custom cistern scupper.
 - 2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 3. Section 077200 "Roof Accessories" for equipment supports, vents, and other manufactured roof accessory units.
 - 4. Sections 084113 (Aluminum-Framed Entrances and Storefronts" and 084413 "Glazed Aluminum Curtain Walls" for sheet metal flashing and trim integral with those systems.
 - 5. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches .

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.7 LEED SUBMITTALS

A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program,

recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.9 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.11 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual"] and] SMACNA's "Architectural Sheet Metal Manual"] requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings] tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F, ambient; 180 deg F , material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666], Type 316, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).
- C. Metallic-Coated Steel Sheet, Unpainted: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation.
 - 1. Surface: Smooth, flat.
 - 2. Finish: Galvanized, unpainted
- D. Coated Steel Sheet, Painted: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Material and exposed coil finish as specified in Section 074113 "Formed Metal Roof Panels "

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder], protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item] unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item].
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. High Temperature Self-Adhering Membrane: Grace Vycor Ultra or equal. Product cannot come in contact with PVC, notify architect if application requires contact with PVC products.
- E. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- F. Elastomeric Sealant: ASTM C 920, elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- I. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. 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.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than dimension indicated on Drawings. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
1. Gutter Profile: Seamless, see drawings
 2. Expansion Joints: Refer to Drawings.
 3. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen.
 4. Gutters with Girth 26 to 30 Inches : Fabricate from the following materials:
 - a. Coated Steel Sheet, Painted: 22
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.]

1. Fabricated Hanger Style: Fig 1-35B according to SMACNA's "Architectural Sheet Metal Manual."

2.6 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings – not indicated to be by others: Fabricate head, sill, jamb,] and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams from:
 1. 22 ga. material by formed metal wall manufacturer at metal wall panel siding
 2. 22 ga. material by solid phenolic siding manufacturer at solid phenolic siding

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 1. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. 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], protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. 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.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.

6. Do not use graphite pencils to mark metal surfaces.
 7. All horizontal flashing surfaces shall slope to drain, out to the exterior away from walls and openings, and back to the roof at parapets.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum] and] stainless-steel] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 12 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
 3. See drawings for locations of expansion provisions at copings and other sheet metal flashing and trim.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. 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 between 40 and 70 deg F , set joint members for 50 percent movement each 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 Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints] or] joints sealed with sealant]. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
 - 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 - 4. Anchor gutter with gutter brackets spaced not more than 48 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 - 5. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
 - 6. Install gutter with expansion joints at locations indicated, but not exceeding, 24 feet (centered on building grid) apart. Install expansion-joint caps.
 - 7. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 - 2. Provide elbows at base of downspout to direct water away from building.
 - 3. Connect downspouts to underground drainage system.

3.4 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

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.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. 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.
- F. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 076200

SECTION 078413 - PENETRATION FIRESTOPPING

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.
- B. Related Requirements:
 - 1. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:

- a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 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. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Grabber Construction Products.
 - d. Hilti, Inc
 - e. HOLDRITE;NUCO Inc.
 - f. RectorSeal.
 - g. Specified Technologies, Inc.
 - h. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg .
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg .
 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 1. Permanent forming/damming/backing materials.
 2. Substrate primers.

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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with 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 penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming 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.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet .
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of

penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:
 1. Provided product to meet all applicable codes.
 2. F-Rating: 1 hour.
 3. T-Rating: 1 hour.
 4. Type of Fill Materials: As required to achieve rating.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

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.
- B. See Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Polysulfide joint sealants.
 - 3. Acoustical joint sealants.
- B. Related Sections:
 - 1. Section 088000 "Glazing" for glazing sealants.
 - 2. Section 092900 "Gypsum Board" for sealing perimeter joints.
 - 3. Section 093013 "Ceramic Tiling" for sealing tile joints.
 - 4. Section 095123 "Acoustical Tile Ceilings" for sealing edge moldings at perimeters with acoustical sealant.
 - 5. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

- 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.
 5. Primer type for each sealant and substrate combination.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and primers (if required) and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- E. Warranties: Sample of special warranties.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:

- a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
- 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference remotely or at project site.

1.8 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet or when they have frost, dew or dirt
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: 20 years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide Dow Corning 795 or equal products from another manufacturer, including, but not limited to the following:
 - a. GE, Momentive SCS 2000 Silpruf
 - b. Tremco Incorporated, Spectrem 2
 - 2. Products for Porous Substrates: Subject to compliance with requirements, provide Dow Corning 790 or equal products from another manufacturer, including, but not limited to the following:
 - a. GE, Momentive SCS 2700 Silpruf LM
 - b. Tremco Incorporated, Spectrem 1
 - 3. Products for Air Barriers air seals at exterior windows and doors: If Dow Corning 795 (or equal) does not adhere properly at air barriers at windows, use Dow Corning 758 (or equal).
- B. Multicomponent, non-sag Traffic-Grade, Neutral-Curing Polyurethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 50, for Use T.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Dynatrol II
 - b. Tremco Dymeric 240

2.3 POLYSULFIDE JOINT SEALANTS

- A. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation; Construction Systems.
 - b. DAP Products Inc.
 - c. ITW Polymers Sealants North America (formerly Pacific Polymers, Inc.)
 - d. Pecora Corporation
 - e. W. R. Meadows, Inc
- B. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation; Construction Systems.
 - b. Pecora Corporation

- C. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Pecora Corporation

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Hilti, Inc
 - b. Pecora Corporation
 - c. Sherwin-Williams Company (The)
 - d. USG Corporation

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; 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. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, Type O (open-cell material), Type B (bicellular material with a surface skin, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Aluminum
 - d. Phenolic cladding / siding.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces -JS-#1.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - 2. Silicone Joint Sealant: Multicomponent, non-sag, traffic grade, neutral curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#2.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between metal panels.
 - c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - 2. Silicone Joint Sealant: single component, nonsag, neutral curing.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#3.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - 2. Silicone Joint Sealant: Multicomponent, pourable, traffic grade, neutral curing except at pool, locker rooms, pool mechanical and associated spaces.
 - 3. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade at pool, locker room, pool mechanical and associated spaces
 - 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#4.

1. Joint Locations:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Tile control and expansion joints.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 2. Silicone Joint Sealant: Multicomponent, nonsag, neutral curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#5.
1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 2. Silicone Joint Sealant: Mildew resistant, single component, nonsag, neutral curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces JS-#6.
1. Joint Location:
 - a. Acoustical joints where indicated.
 2. Joint Sealant: Acoustical.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- G. Joint-Sealant Application: joints at primary air seal if air/weather barrier cannot be achieved with Dow Corning 795, vertical and horizontal surfaces, JS-#7
1. Joint Locations:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Perimeter joints between interior wall surfaces and frames of exterior doors and windows.
 2. Silicone Joint Sealant: Dow Corning 758 (or equal).
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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.
- B. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
 - 2. Section 099123 "Interior Painting" for primer and paint system information for interior hollow metal doors and frames.
 - 3. Section 099600 "High Performance Coatings" for primer and high-performance coating system information for exterior hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 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. 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 final Door Hardware Schedule.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide additional protection to prevent damage to 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 vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- B. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS

- A. 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. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. DKS Steel Door & Frame Systems, Inc.
 - 4. Gensteel Doors, Inc.
 - 5. Security Metal Products; a brand of ASSA ABLOY.
 - 6. Steelcraft; an Allegion brand
 - 7. Mesker; a dormakaba brand
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.3 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.4 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches .
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch .
 - d. Edge Construction: Model 1, Full Flush.

- e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
- 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch .
 - b. Construction: Face welded.
- 4. Exposed Finish: Primer, compatible with specified paints in Section 099123 "Interior Painting."

2.5 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch , with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Polyisocyanurate.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch , with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Primer, compatible with specified paints in Section 099600 "High Performance Coatings."
 - 5. Insulation: Pack exterior door frames with mineral wool insulation prior to install.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch , and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.7 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. 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 hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches , as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Glazing: Comply with requirements in Section 088000 "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 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 metal thickness. 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. Hollow-Metal Doors:
 1. Fire Door Cores: As required to provide fire-protection ratings indicated.
 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.

4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 6. 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 or as required to comply with published listing of qualified testing agency.
- C. 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches high.
 - 2) Five anchors per jamb from 90 to 96 inches high.
 - 3) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 6. Door Silencers: Except on weather-stripped frames, 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.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 2. Provide loose stops and moldings on inside of hollow-metal work.

3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.10 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

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. 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.
- E. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

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. Drill and tap doors and frames to receive non-templated, 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 SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 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-rated openings, install frames according to NFPA 80.
 - b. Install door silencers in frames before grouting.
 - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 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 Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch .
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch .
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch .
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch .
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

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 Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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.
- B. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Doors with glazing
 - 3. Factory finishing flush wood doors.
 - 4. Factory fitting flush wood doors to frames and factory machining for hardware.
 - 5. Stile and rail wood exterior door
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for frames that flush wood doors are mounted within.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, 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; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Stops for light openings, 6 inches long, for each material, type, and finish required.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD 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 remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: 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 0.01 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 MANUFACTURERS

- A. 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. Algoma Hardwoods, Inc.
 - 2. Construction Specialties, Inc
 - 3. Eggers Industries.
 - 4. General Veneer Manufacturing Co.
 - 5. Oregon Door
 - 6. Vancouver Door Company.
 - 7. VT Industries Inc.
- B. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. 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 .

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors

1. Grade: Custom (Grade A faces).
2. Species: Select white oak
3. Cut: Quarter sawn.
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Either glued wood stave or structural composite lumber.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

2.5 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 NFPA 80 requirements for fire-rated doors.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Custom.

2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Finish: WDMA TR-6 catalyzed polyurethane.
4. Staining: As selected by Architect from manufacturer's full range.
5. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
6. Sheen: Satin.

2.7 STILE AND RAIL WOOD EXTERIOR DOOR

A. Main Entry Doors

1. Manufacturer: Pella Exterior Commercial Grade, Architect Series, or approved equal.
2. Species: Mahogany
3. Finish: As selected from manufacturer's standard line.
4. Glass: Clear, full-lite, no grilles
5. Frame: Not by Pella, install in curtainwall system

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed 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.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

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 that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, materials, individual components and profiles, and finishes.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. 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:

- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Exposed Flanges
 - 1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
 - 2. Locations: Wall and ceiling.
 - 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage.
 - a. Finish: Factory prime.
 - 4. Stainless-Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage.
 - a. Finish: No. 4.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Hinges: Manufacturer's standard.
 - 7. Hardware: Lock.
- D. Hardware:
 - 1. Latch: Cam latch, verify lock operation method / tool with owner.
 - 2. Lock: Cylinder.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
- D. Frame Anchors: Same type as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

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 doors to types of supports indicated.

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.
 - 2. At all location unless otherwise noted.
- E. Stainless-Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. At tiled walls and kitchen walls
 - 3. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for 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. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 083113

SECTION 08 33 26 – OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electric operated overhead rolling security grille at Kitchen pass-through window.
- B. Related Sections:
 - 1. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Cycle Life:
 - a. Design grilles of standard construction for normal use of up to 20 cycles per day maximum.

1.3 SUBMITTALS

- A. Submit the following items:
 - 1. Product Data for all components and accessories.
 - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work, including but not limited to the self-supporting tube steel elevations and details.
 - 3. Quality Assurance/Control Submittals:
 - a. Provide proof of manufacturer ISO 9001:2008 registration.
 - b. Provide proof of manufacturer and installer qualifications - see 1.4 below.
 - c. Provide manufacturer's installation instructions.
 - 4. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: ISO 9001:2008 registered and a minimum of five years experience in producing grilles of the type specified.
 - 2. Installer Qualifications: Manufacturer's approval.

1.5 DELIVERY STORAGE AND HANDLING

- A. Follow manufacturer's instructions.

1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. 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. Cornell Iron Works, Inc.
 - 2. The Cookson Company, Inc.
 - 3. Amarr
 - 4. Clopay
- B. Basis-of-Design Product: Cornell Iron Works, Visionaire Model ESG12 Motorized Rolling Security Grille

2.2 MATERIALS

- A. Curtain:
 - 1. ESG12 Brick Pattern
 - a. Horizontal Rods: Solid 5/16 inch (8 mm) diameter, 5056 H32 aluminum alloy sleeved with horizontal aluminum tube spacers to separate vertical links.
 - 1. Vertical Spacing 2 inches (50.8 mm)
 - b. Vertical Links: Heavy duty aluminum links, 3/4 inch (19mm) wide, positioned by tube spacers on 9 inch (228.6 mm) staggered centers. End links to be held in place by self-locking retaining rings.
 - 2. Bottom Bar: 2 x 3-1/2 inch (50.8 x 88.9 mm) extruded aluminum tubular section.
 - 3. Finish:
 - a. Aluminum Curtain and Bottom Bar:
 - 1. Curtain: Mill finish.
 - 2. Bottom Bar: Mill finish
- B. Guides, Tube Mounted: Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners and polypropylene pile runners on both sides of curtain. Provide aluminum tubes, floor saddles and hardware as recommended by manufacturer to support grille.
 - 1. Finish, Aluminum Guide Components: Mill finish
- C. Counterbalance Shaft Assembly:
 - 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
 - 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25lbs (110 N). Provide wheel for applying and adjusting spring torque.
- D. Brackets: Fabricate from minimum 3/16 inch (4.76 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - 1. Finish: Phosphate treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
- E. Self-Supporting Tube Steel Assembly
 - 1. Factory prepared tube steel for the attachment of all grille components.

2. Attach tubes to the floor slab below and the joists above, thereby becoming self-supporting, per manufacturer's installation instructions.
3. Finish: primed for interior painting, all steel, brackets and fasteners. See Division 09.

2.3 ACCESSORIES

- A. Locking:
1. Motor Operated: Keyed cylinder locking into both jambs operable from both sides of curtain with motor interlock cutout switches.

2.4 OPERATION

- A. Supply Cornell Model MG Electric Motor Operator, industrial duty - rated for a maximum of 20 cycles per hour, cULus listed, Totally Enclosed Non Ventilated gear head operators rated HP as recommended by door manufacture for size and type of door. Volt and phase power requirements per electrical and as recommended by door manufacture. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake and control station. Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 6 to 9 inches per second (15 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions and as noted in the bid documents.
1. Control Station: Flush mounted, "Open/Close" key switch with "Stop" push button; NEMA 1B.
- B. Provide operator to function with constant pressure close operation to meet UL325-2010 listing standard requirements.
1. Provide a continuously monitored, concealed, wireless sensing/weather edge seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
- C. Sensing/Weather Edge: Provide automatic reversing control by an automatic sensing switch with in neoprene or rubber astragal extending full width of grille bottom bar.
1. Provide an electric sensing edge device. Contact before grille fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

- C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

- A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. Follow manufacturer's installation instructions.

3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of operation, free from warp, twist, or distortion.

3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

END OF SECTION 083326

SECTION – 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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.
- B. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Storefront framing, at all interior relite / borrowed light conditions (unless noted otherwise) and interior entrances
 - 2. Exterior storefront framing, where shown.
 - 3. Exterior entrance doors.
 - 4. Aluminum operable windows to be installed in storefront systems.
 - 5. Flashings indicated to be provided and installed by this section.
 - 6. Breakshapes and sill flashings/pans at storefront conditions.
- B. Related Sections:
 - 1. Section 088000 "Glazing" for glazing sealants and glass types
 - 2. Section 084413 "Glazed Aluminum Curtain Walls" for curtain wall assemblies by same manufacturer of this section
 - 3. Section 087100 "Door Hardware" for door hardware.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- 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 vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.

1.5 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
- B. Test Reports indicating compliance with air leakage and water penetration resistance as specified.
- C. Sample Warranties: For special warranties.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. 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.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship 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 created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
 - f. Water infiltration.
- B. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch , whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch , whichever is smaller.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- D. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
- E. Air Infiltration, for exterior storefronts and entrances: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .
 - 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .

- b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. .
- G. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- H. Energy Performance: Refer to drawings for requirements. Certify and label energy performance according to NFRC.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.
- J. LEED Performance Requirements:
 - 1. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS

- A. Basis-of-Design Product, Exterior Storefront and Entrances: Subject to compliance with requirements, provide Kawneer 451UT, thermally broken, or comparable product by one of the following:
 - 1. CMI Architectural.
 - 2. Commercial Architectural Products, Inc.
 - 3. EFCO Corporation.
 - 4. U.S. Aluminum; a brand of C.R. Laurence.
 - 5. Vistawall Architectural Products.
- B. Basis-of-Design Product, Interior Storefront and Entrances: Subject to compliance with requirements, provide Kawneer Tri-Fab 400, non-thermally broken or comparable product by one of the following:
 - 1. CMI Architectural.
 - 2. Commercial Architectural Products, Inc.
 - 3. EFCO Corporation.
 - 4. U.S. Aluminum; a brand of C.R. Laurence.
 - 5. Vistawall Architectural Products

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken and nonthermal based on specified products.

2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Centered
 4. Finish: Anodized, Bronze.
 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 .
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 .
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's glazed entrance doors for manual-swing operation.
1. Basis-of-Design Product, Exterior Doors: Subject to compliance with requirements, provide Kawneer Tuffline doors, or comparable product by one of the following:
 - a. CMI Architectural.
 - b. Commercial Architectural Products, Inc.
 - c. EFCO Corporation.
 - d. U.S. Aluminum; a brand of C.R. Laurence.
 - e. Vistawall Architectural Products.
 2. Door Design:
 - a. Medium stile; 3-1/2-inch nominal width
 - b. Color: Match adjacent storefront or curtainwall color.
 - c. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

2.5 OPERABLE WINDOWS

- A. Basis-of-Design Product, Exterior Aluminum Operable Windows: Subject to compliance with requirements, provide Kawneer GLASSvent, thermally broken, or comparable product by one of the following:
1. CMI Architectural.
 2. Commercial Architectural Products, Inc.
 3. EFCO Corporation.
 4. U.S. Aluminum; a brand of C.R. Laurence.
 5. Vistawall Architectural Products.

2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. Pivot Hinges: BHMA A156.4, Grade 1.
 - 1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

2.7 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.8 ACCESSORIES

- A. 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.
- B. 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.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Exposed Flashing, Breakshapes, and Sill Flashing and Breakshapes: .063" thick aluminum sheet finished to match adjacent storefront and entrance doors. Size and design requirements per drawings.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. 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.
- C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Storefront Framing: Fabricate components for assembly using screw-spline system.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Four-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF 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: Manufacturer's anodized; bronze.

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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with 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.

3.3 INSTALLATION

- A. General:
1. Comply with manufacturer's written instructions.

2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing: Test at least on area of 200 sf for water infiltration according to ASTM E1105 at a pressure of 2/3 of the specified lab pressure, but not less than 6.25 PSF using the static pressure method with results showing no evidence of water infiltration.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 08 41 13

SECTION – 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

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. Glazed aluminum curtain walls.
 2. Flashings indicated to be provided and installed by this section
 3. Breakshapes and sill flashings/pans at curtain walls.
- B. Related Requirements:
 1. Section 088000 "Glazing" for glazing sealants and glass types
 2. Section 084113 "Aluminum Framed Storefront and Entrances" for storefront and entrances by same manufacturer of this section.
 3. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- 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 vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and field-testing agency.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- E. Source quality-control reports.
- F. Sample Warranties: For special warranties.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program,

recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. 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.
 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of curtain wall assemblies.

1.9 MOCKUPS

- A. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical wall area as shown on Drawings.
 2. Testing shall be performed on mockup according to requirements in "Field Quality Control" Article. Testing of mockup shall occur prior to commencing the balance of the work.
 3. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship 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 created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
 - f. Water penetration.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding $1/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller.
 - a. Operable Units: Provide a minimum $1/16$ -inch clearance between framing members and operable units.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or 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.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
- I. Energy Performance: Refer to drawings for requirements. Certify and label energy performance according to NFRC.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- K. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
 2. Designed to produce tensile or shear stress of less than 20 psi.

- L. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- M. LEED Performance Requirements:
 - 1. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 1600 UT or comparable product by one of the following:
 - 1. EFCO Corporation.
 - 2. Oldcastle, Inc.
 - 3. U.S. Aluminum; a brand of C.R. Laurence
- B. Curtain Wall System: 2 ½" x 7 ½" frames
- C. Source Limitations: Obtain all components of curtain wall system, including framing venting windows, entrances, sun control supports and panels, and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken.
 - 2. Glazing System Without Structural Glazing: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front.
 - 4. Finish: High-performance organic finish.
 - 5. Fabrication Method: Either factory- or field-fabricated system.
- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - 1. Include snap-on aluminum trim that conceals fasteners.
 - a. 1 1/2" caps unless otherwise shown.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209 .
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 .
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCES

- A. Entrances: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Sealants: As recommended by manufacturer.
- C. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.
- D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
1. Color: To be determined.

2.6 ACCESSORIES

- A. Fasteners: Manufacturer's standard stainless steel, nonstaining, nonbleeding fasteners compatible with adjacent materials.
- B. 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.
- C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch 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. Exposed Flashing, Breakshapes, and Sill Flashing and Breakshapes: .063" thick aluminum sheet finished to match adjacent curtain wall.
- F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. 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.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from exterior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 7. Components curved to indicated radii.
- D. Fabricate components to resist water penetration as follows:
 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory-Assembled Frame Units:
 1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
 3. Preparation includes, but is not limited to, cleaning and priming surfaces.
 4. Seal joints watertight unless otherwise indicated.
 5. Install glazing to comply with requirements in Section 088000 "Glazing."
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Anodized, Bronze.

2.9 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. 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.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - 7. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum is in 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 glazed aluminum curtain wall to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

- F. Install glazing as specified in Section 088000 "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.
- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- H. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet ; 1/4 inch in 40 feet .
 - 2. Level: 1/8 inch in 20 feet ; 1/4 inch in 40 feet .
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on mockups.
 - 1. Water Penetration: ASTM E 1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 10 lbf/sq. ft., and shall not evidence water penetration. 4 tests total.
- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 084413

SECTION 08 54 13 - FIBERGLASS WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass fixed frame windows.
- B. Mulled-joint covers

1.2 RELATED SECTIONS

- A. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.
- B. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 - 2. AAMA 623 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 1036 - Flat Glass.
 - 2. ASTM C 1048 - Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
 - 3. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 - 4. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
 - 5. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- C. Window and Door Manufacturers Association (WDMA):
 - 1. ANSI/AAMA/NWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

1.4 PERFORMANCE REQUIREMENTS

- A. Windows shall meet Rating FW-CW-PG specifications in accordance with ANSI/AAMA/NWDA 101/I.S.2/A440-08.
- B. Window Air Leakage, ASTM E 283: Window air leakage when tested at 1.57 psf (25 mph) shall be 0.25 cfm/ft² of frame or less.
- C. Window Water Penetration, ASTM E 547: No water penetration through window when tested under static pressure of 7.5 psf (54 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including installation instructions.
- B. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

- C. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.7 QUALITY ASSURANCE

- A. Mockup:
 - 1. Provide sample installation for field testing window performance requirements and to determine acceptability of window installation methods.
 - 2. Approved mockup shall represent minimum quality required for the Work.
 - 3. Approved mockup shall remain in place within the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Store materials off ground and under cover.
 - 3. Protect materials from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.
- B. Or approved equal by Architect

2.2 FIBERGLASS FIXED FRAME WINDOWS

- A. Fixed Frame Windows: Pella Impervia.
 - 1. Factory-assembled fixed frame window.
 - 2. Frame Material: Duracast. 5-layer, pultruded-fiberglass, reinforced with interlocking mat.

- B. Frame:
 - 1. Type: Block frame.
 - 2. Interior and Exterior Frame: Pultruded, fiberglass composite with foam inserts.
 - 3. Overall Frame Depth: 3 inches.
 - 4. Nominal Wall Thickness of Fiberglass Members: 0.050 inch to 0.080 inch.
 - 5. Frame Corners:
 - a. Mitered.
 - b. Joined and bonded with thermoset polyurethane adhesive, nylon corner lock, and mechanically fastened.
 - 6. Frame installed with glazing stop on interior or exterior (unit can be flipped to install in either direction).
 - 7. Jambs: Contain optional factory-drilled, counter-bored, installation screw holes.
 - 8. Head and Sill: Contain optional factory-drilled, counter-bored, installation screw holes.
- C. Glazing:
 - 1. See Section 088000 Glazing.

2.3 TOLERANCES

- A. Windows shall accommodate the following opening tolerances:
 - 1. Vertical Dimensions Between High and Low Points: Plus 1/4-inch, minus 0 inch.
 - 2. Width Dimensions: Plus 1/4-inch, minus 0 inch.
 - 3. Building Columns or Masonry Openings: Plus or minus 1/4-inch from plumb.

2.4 FINISH

- A. Exterior and Interior Duracast Finish: Factory-applied powder-coat paint, comply with AAMA 623.
 - 1. Single-color: Black or brown pending sample submittal approval.

2.5 INSTALLATION ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
 - 1. Aluminum-foil-backed butyl window and door flashing tape.
 - 2. Maximum Total Thickness: 0.013 inch.
 - 3. UV resistant.
 - 4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.
- C. Block Frame Installation Accessories: Vinyl installation fin with head drip flashing at new construction openings.

2.6 MULLION COVERS

- A. Mullion Covers: Standard and custom sized break metal mullion covers by fiberglass fixed frame manufacturer.
- B. Material: 0.050" Aluminum
- C. Finish: To Match Fiberglass Window Frames
- D. Location: Per Drawings

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows to be weather-tight.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's instructions.
- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating foam sealant.
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 FIELD QUALITY CONTROL

- A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

3.4 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish or glass.
- C. Remove labels and visible markings.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.5 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 54 13

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for aluminum doors.
 - 3. Door hardware for wood doors.
 - 4. Door hardware for other doors indicated.
 - 5. Keyed cylinders as indicated.
- B. Related Sections:
 - 1. Division 6: Rough Carpentry.
 - 2. Division 8: Aluminum Doors and Frames
 - 3. Division 8: Hollow Metal Doors and Frames.
 - 4. Division 8: Wood Doors.
 - 5. Division 8 Glass & Glazing
 - 6. Division 26 Electrical
 - 7. Division 28: Electronic Security
 - 8. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.
- C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. Builders Hardware Manufacturing Association (BHMA)
 - 2. NFPA 101 Life Safety Code
 - 3. NFPA 80 Fire Doors and Windows
 - 4. ANSI-A156 Various Performance Standards for Finish Hardware
 - 5. UL10C Positive Pressure Fire Test of Door Assemblies
 - 6. ANSI-A117.1 Accessible and Usable Buildings and Facilities
 - 7. DHI /ANSI A115.IG Installation Guide for Doors and Hardware
 - 8. ICC International Building Code
- D. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
 - 2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- E. Regulatory and Operational Requirements:
 - 1. Provide hardware for all openings, whether specified or not, in compliance with NFPA Standard No. 80, proper operation and local building code requirements. Where required, provide only hardware which has been tested and listed by UL or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Label hardware, as required, for compliance with pressure testing criteria as dictated in IBC.

2. Provide hardware which meets or exceeds handicap accessibility per local building code requirements. Conform to the Americans with Disabilities Act (ADA) of 1990 as amended by the D.O.J. September 15, 2010, as adopted by the Authority Having Jurisdiction (AHJ).

E. Allowances

1. Refer to Division 1 for allowance amount and procedures.

F. Alternates

1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

- A. Comply with Division 1.

1.3 SUBMITTALS:

- A. Comply with Division 1.

- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

- C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.
3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

- F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 LEED SUBMITTALS

A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.

- a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 - 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
 - B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Packing and Shipping: Comply with Division 1.
 - 1. Deliver products in original unopened packaging with legible manufacturer's identification.
 - 2. Package hardware to prevent damage during transit and storage.
 - 3. Mark hardware to correspond with "reviewed hardware schedule".
 - 4. Deliver hardware to door and frame manufacturer upon request.
 - B. Storage and Protection: Comply with manufacturer's recommendations.
- 1.7 PROJECT CONDITIONS:
- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
 - B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.
- 1.8 WARRANTY:
- A. Refer to Conditions of the Contract
 - B. Manufacturer's Warranty:
 - 1. Closers: Lifetime
 - 2. Exit Devices: Five Years
 - 3. Locksets & Cylinders: Three years
 - 4. All other Hardware: Two years.
- 1.9 OWNER'S INSTRUCTION:
- A. Instruct Owner's personnel in operation and maintenance of hardware units.
- 1.10 MAINTENANCE:
- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.

1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- B. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS:

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Bommer, McKinney
Locksets	Best 9K	Dorma C800, Schlage ND
Cylinders	Best Patented	Dorma Patented, Schlage Everest 29
Exit Devices	Dorma	Precision, Von Duprin
Closers	Best HD7016	Dorma 8900, Norton 7500
Push/Pull Plates	Trimco	Burns, Rockwood
Push/Pull Bars	Trimco	Burns, Rockwood
Protection Plates	Trimco	Burns, Rockwood
Overhead Stops	ABH	Rixson, Glynn Johnson
Door Stops	Trimco	Burns, Rockwood
Flush Bolts	Trimco	ABH, Burns
Coordinator & Brackets	Trimco	ABH, Burns
Threshold & Gasketing	National Guard	Reese, Pemko

2.3 MATERIALS:

- A. Hinges: Shall be Five Knuckle Ball bearing hinges
1. Template screw hole locations
 2. Bearings are to be fully hardened.
 3. Bearing shell is to be consistent shape with barrel.
 4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
 5. Equip with easily seated, non-rising pins.
 6. Non-Removable Pin screws shall be slotted stainless steel screws.
 7. Hinges shall be full polished, front, back and barrel.
 8. Hinge pin is to be fully plated.
 9. Bearing assembly is to be installed after plating.

10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Cylindrical Type Locks and Latchsets:

1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Fit modified ANSI A115.2 door preparation.
4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
5. Locksets to have anti-rotational studs that are thru-bolted
6. Keyed lever shall not have exposed "keeper" hole
7. Each lever to have independent spring mechanism controlling it
8. 2-3/4-inch (70 mm) backset
9. 9/16 inch (14 mm) throw latchbolt
10. Provide sufficient curved strike lip to protect door trim
11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
12. Keyed lever to be removable only after core is removed, by authorized control key
13. Provide locksets with 7-pin removable and interchangeable core cylinders
14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
15. Locksets outside locked lever must withstand minimum 1400-inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
16. Core face must be the same finish as the lockset.
17. Functions and design as indicated in the hardware groups.

C. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking 3/4" through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have 1/4" minimum turn hex key dogging.
8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a 1/4" clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.

15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Approved Manufacturers
 - a. The following manufacturers will be approved contingent on meeting or exceeding the above performance criteria:
 - 1) Dorma Manufactured by Dormakaba USA

D. Exit Devices with Weatherized True Architectural Finish 613/630:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory to meet or exceed the following:
 - A. Mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
 - B. BHMA 156.3 – A156.18 Salt Spray Certified 600 Hours 3 X Standard.
 - C. MIL-STD-810G 509.6 Salt Fog Certified.
 - D. MIL-STD-810G 510.6 Sand & Dust Certified.
 - E. MIL-STD-810G 521.4 Icing/Freezing Rain Certified.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking $\frac{3}{4}$ " through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have $\frac{1}{4}$ " minimum turn hex key dogging.
8. All Exterior components of the exit device including the Active case cover, Touch bar, device channel, slide channel fillers, Vertical rods, latch covers and device end cap, shall be constructed of a brass base metal then plated in a double dip two step process of satin nickel and chrome.
9. Exit device shall be available with options of WTS Weatherized touch bar switch and WALW Weatherized Exit alarm (hardwired)
10. Additional non-weatherized electrified options are compatible with the 626W. Non-weatherized options are not recommended for harsh environments.
11. Touchpad to be "T" style constructed.
12. Touchbar assembly on wide style exit devices to have a $\frac{1}{4}$ " clearance to allow for vision frames.
13. All exposed exit device components to be of architectural metals and "true" architectural finishes.
14. Provide strikes as required by application.
15. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
16. The strike is to be black powder coated finish.
17. Exit devices to have field reversible handing.
18. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
19. Provide 9001-Quality Management and 14001-Environmental Management.
20. Vertical Latch Assemblies to have gravity operation, no springs.
21. Approved Manufacturers
 - a. The following manufacturers will be approved contingent on meeting or exceeding the above performance criteria:
 - 1) Precision with 626W finish, Manufactured by Stanley Security Solutions

E. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

F. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1
2. UL10C certified
3. Provide 9001-Quality Management and 14001-Environmental Management.
4. Closer shall have extra-duty arms and knuckles
5. Conform to ANSI 117.1
6. Maximum 2 7/16 inch case projection with non-ferrous cover
7. Separate adjusting valves for closing and latching speed, and backcheck
8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
9. Full rack and pinion type closer with 1½"/36mm minimum bore
10. Mount closers on non-public side of door, unless otherwise noted in specification
11. Closers shall be non-handed, non-sized and multi-sized.

G. Low Energy Operators shall:

1. Conform to ANSI/BHMA A156.19 as a low energy power opening device.
2. Be listed under UL228, UL325, UL10B, UL10C, UBC 7.2 and FCC listed.
3. Shall be non-handed.
4. Be rated for door panels weighing up to 350 lbs (160 kg).
5. The manual door closer within the Low Energy Operator shall be adjusted to meet Americans with Disabilities Act (ADA) 5 lbs opening force [Push-Side applications only]
6. Operator shall be isolated from mounting plate with rubber mounts to mitigate the transmission of forces between the door and the operator.
7. Shall have a position encoder to communicate with microprocessor.
8. Incorporate a resetable powered operation counter that tracks both powered and non-powered cycling of the Operator.
9. Incorporate the following adjustable settings:
 - i. Hold Open Timer, to 28 seconds
 - ii. Open Speed
 - iii. Backcheck Speed
 - iv. Vestibule Sequence Timer
10. Include DIP switch controls for:
 - i. On board diagnostics
 - ii. Power close
 - iii. Push and Go operation
 - iv. Time delay logic for electrified hardware components
11. Include terminals for auxiliary controls including:
 - i. Activation devices; provide two discrete inputs
 - ii. Vestibule sequencing
12. Control switches including:
 - i. Day/Night open (illuminated)
 - ii. Power On-Off
13. Includes adhesive Low Energy Operator mounting templates.
14. R-14 Aluminum Allow Materials
15. For non-powered operation, the unit shall function as a standard door closer with adjustable spring force size 1 thru 6.

H. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.

1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- I. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
 2. Surface overhead stops shall be heavy duty bronze or stainless steel.
- J. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
- K. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plates with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
- L. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- M. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish. See door schedule for locations.
- N. Door Bolts: Flush bolts for wood or metal doors.
1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
 2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
 3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
 4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.
- O. Electric Door Strike: Certified by ANSI/BHMA 156.31, Grade 1. and listed for Burglary Protection ANSI/ UL1034 Grade 1.
1. For General use provide fail-secure electric strike and with fire-rated device.
 2. Listed UL10C for Fire Door assemblies
 3. Latchbolt monitor switch option when specified in hardware sets.
 4. Provide the electric strike in the appropriate model that will accept a 5/8" or 3/4" latchbolt.
- P. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- Q. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.

- R. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- S. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.
- T. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.4 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.5 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. 1 each Grand Masterkeys
 - 2. 4 each Masterkeys
 - 3. 2 each Change keys each keyed core
 - 4. 15 each Construction masterkeys
 - 5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.

3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.
- B Approximately six months after the acceptance of hardware in each area, the hardware installer shall:
1. Return to the project and re-adjust every item of hardware to restore proper function of doors and hardware.
 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
 3. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units.
 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware and submit to the Architect.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.6 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

<u>Code</u>	<u>Name</u>	<u>Description</u>
AB	ABH Manufacturing Inc.	Overhead Stops
AC	Accurate Hardware	Narrow Stile Mortise Locks
BE	Best Access Systems	Locks, Closers, Cylinders, Electric Strike
DM	Dorma Door Controls	Exit Devices, Door Position Switches
NA	National Guard	Thresholds, Gaskets
PR	Precision	MLR Power Supply
ST	Stanley	Hinges, Wire Harnesses
TR	Trimco	Stops, Flat Goods

Finish List

<u>Code</u>	<u>Finish</u>
313	Dark Bronze Anodized
613/640	Oxidized Satin Bronze, Oil Rubbed
626/652	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
695	Dark Bronze Painted
GREY	Grey

Option List

<u>Code</u>	<u>Description</u>
C	Interchangeable Core Cylinder (Dorma)
J	Less IC Core (Dorma)
CD	Cylinder Dogging (Dorma)
LB	Less Bottom Rod (Dorma)
MLR	Motorized Latch Retraction (Dorma)
MS	Touchbar Monitor Switch (Dorma)
CS	Counter Sinking Of Kick And Mop Plates (Trimco)
B4E	Beveled 4 Edges - Kick and Mop Plates (Trimco)
N Mounting	Spanner Through Bolt Mounting (Trimco)
L Mounting	Spanner Back to Back Mounting (Trimco)
MS/ES	1/4-20 Machine Screw/Expansion Anchor (NGP)
SSMS/EA	Stainless Machine Screws/Expansion Anchor (NGP)
SMS-TEKS	Self-Drilling Screws Sheet Metal Screws (NGP)

Hardware Sets

SET #1 - Main Entry - Automatic - Card Access

Door: 100A

6	Hinges	CB199 4 1/2 X 4 1/2 NRP	613	ST
2	Electric Hinges	CECB199-12C 4 1/2 X 4 1/2	613	ST
*1	Exit Device	9400B x OP02 C J LB MLR MS	613	DM
*1	Exit Device	9400B x OP02 J LB MLR MS	613	DM
1	Cormax Cor	1CX-7 PATD	613	BE
1	Operator Set	See section 087113		
2	Kick Plates	K0050 8" x 2" LDW B4E CS	613	TR
2	Door Stops	1214H	613	TR
1	Gasketing Set	A605 DKB SET		NA
1	Gasketing	700 NDKB		NA
2	Door Sweeps	200 NDKB		NA
1	Saddle Threshold	426 BR MS/EA	613	NA
*2	Wire Harnesses	WH-6E		ST
*2	Wire Harnesses	WH-12P		ST
*2	Wire Harnesses	WH-192		ST
*1	Power Supply	RPSMLR2		PR
*2	Door Position Switches	MC4		DM

Card activation momentarily retracts latches, energizes outside operator switch and allows access. Card reader by security access. Do not cut weatherstrip - template hardware accordingly. Verify threshold application.

SET #2 - Vestibule - Automatic

Door: 101A

8	Hinges	CB168 4 1/2 X 4 1/2	640	ST
2	Push/Pull Sets	1738 Type L & N Mounting	613	TR
1	Operator Set	See section 087113		
2	Kick Plates	K0050 8" x 2" LDW B4E CS	613	TR
2	Door Stops	1215CKU	613	TR
1	Gasketing Set	A605 DKB SET		NA

SET #3 - Exterior

Doors: 101B, 101C

1	Continuous Hinge	661HD	313	ST
1	Exit Device	9700BB x OP02 C CD J	613	DM
1	Cormax Core	1CX-7 PATD	613	BE
1	Closer	HD7016 SPA BP70	695	BE
1	Door Stop	1214H	613	TR
1	Door Sweep	200 NDKB		NA
1	Saddle Threshold	426 BR MS/EA	613	NA
*1	Door Position Switch	MC4		DM

Gaskets by door manufacturer. Verify threshold application.

SET #3A - Exterior - Card Access

Door: 101D

1	Continuous Hinge	661HD	313	ST
1	Exit Device	9700BB x OP02 C CD J	613	DM
1	Cormax Core	1CX-7 PATD	613	BE
*1	Electric Strike	BES-0162	630	BE
1	Door Stop	1214H	613	TR
1	Door Sweep	200 NDKB		NA
1	Saddle Threshold	426 BR MS/EA	613	NA
*1	Door Position Switch	MC4		DM

Card activation momentarily releases strike and allows access. Card reader and power source by security access. Gaskets by door manufacturer. Verify threshold application.

SET #4 - Kitchen/Classroom

Doors: 101E, 114A, 114B

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
1	Lockset	9K3-7R15D PATD	626	BE
1	Closer	HD7016 SPA	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SET #5 - Office

Doors: 103A, 104A, 105A, 123A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7AB15D PATD	626	BE
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

SET #6 - Fitness/Maintenance

Doors: 106A, 124A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7R15D PATD	626	BE
1	Closer	HD7016 JT	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

SET #7 - Janitor

Door: 107A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Lockset	9K3-7D15D PATD	626	BE
1	Closer	HD7016 JT	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

SET #8 - Restroom

Doors: 108A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Privacy Set	9K3-0L15D	626	BE
1	Closer/Stop	HD7016 IS	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Gasketing	5040 B		NA

SET #9 - TV Room

Doors: 110A, 111A

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
1	Lockset	9K3-7R15D PATD	626	BE
1	Closer/Stop	HD7016 SDS	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Gasketing	5040 B		NA

SET #10 - Restroom

Doors: 109A, 112A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Privacy Set	9K3-0L15D	626	BE
1	Closer	HD7016 SPA	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SET #11 - Library

Doors: 113A, 113B

1	Continuous Hinge	661HD	DB	ST
1	Lockset	8856.175.39L/1R	613	AC
1	Mortise Cylinder	1E-74 PATD	613	BE
1	Closer	HD7016 SPA BP70	695	BE
1	Door Stop	1215CKU	613	TR
1	Door Sweep	200 NDKB		NA
1	Saddle Threshold	426 BR MS/EA	613	NA
1	Door Position Switch	MC4		DM

Gaskets by door manufacturer. Verify threshold application.

SET #12 - Storage

Doors: 115A, 125A, 126A

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
1	Lockset	9K3-7D15D PATD	626	BE
1	Wall Bumper	1270WV	630	TR
3	Door Silencers	1229A	GREY	TR

SET #13 - Restroom

Doors: 116A, 117A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Pull Plate	1018-3	630	TR
1	Push Plate	1001-9	630	TR
1	Closer	HD7016 JT	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SET #14 - Classroom

Door: 118A

3	Hinges	CB168 4 1/2 X 4 1/2 NRP	652	ST
1	Exit Device	9400B x YR08 C CD J	630	DM
2	Cormax Core	1CX-7 PATD	626	BE
1	Closer	HD7016 SPA	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SET #15 - Classroom/Dining Room

Doors: 118B, 121A

1	Continuous Hinge	661HD	313	ST
1	Exit Device	9700BB x OP02 C CD J	613	DM
1	Cormax Core	1CX-7 PATD	613	BE
1	Closer	HD7016 SPA BP70	695	BE
1	Door Stop	1215CKU	613	TR
Gaskets by door manufacturer.				

SET #16 - Closet

Doors: 119A

6	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
2	Flush Bolts	3913	626	TR
1	Dustproof Strike	3911	630	TR
1	Lockset	9K3-7R15D PATD	626	BE
2	Wall Bumpers	1270WV	630	TR
1	Astragal	139 A		NA
2	Door Silencers	1229A	GREY	TR
Apply astragal to inactive leaf. Inactive leaf for movement of materials only.				

SET #17 - Restroom

Door: 122A

3	Hinges	CB179 4 1/2 X 4 1/2	652	ST
1	Privacy Set	9K3-0L15D	626	BE
1	Closer	HD7016 JT	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Mop Plate	KM050 6" x 1" LDW B4E CS	630	TR
1	Wall Bumper	1270WV	630	TR
1	Gasketing	5040 B		NA

SET #18 - IT/Electrical

Doors: 127A, 128A

3	Hinges	CB179 4 1/2 X 4 1/2 NRP	652	ST
1	Lockset	9K3-7D15D PATD	626	BE
1	Overhead Stop	4420 SERIES	630	AB
1	Gasketing	5040 B		NA

SET #19 - Kitchen

Door: 129B

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Exit Device	9400B x YR08 C CD J	630	DM
2	Cormax Core	1CX-7 PATD	626	BE
1	Closer	HD7016 SPA	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Door Stop	1214H	626	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Door Sweep	200 NA SMS-TEKS		NA
1	Saddle Threshold	426 SSMS/ES		NA
*1	Door Position Switch	MC4		DM

Do not cut weatherstrip - template hardware accordingly. Verify threshold application.

SET #20 - Kitchen

Door: 129C

1	Concealed Closer	RTS/04 BFI	689	DM
1	Deadlock	8T3-7M PATD	626	BE
2	Push Plates	1001-9	630	TR
2	Kick Plates	K0050 10" x 2" LDW B4E CS	630	TR
2	Wall Bumpers	1270WV	630	TR

Double acting. Door not required for exit.

SET #21 - Dining

Doors: 130A, 130B

2	Continuous Hinge	661HD	313	ST
1	Exit Device	9600BB x OP02 CD J	613	DM
1	Exit Device	9600BB x OP02 C CD J	613	DM
3	Cormax Cores	1CX-7 PATD	613	BE
2	Closers	HD7016 SPA	695	BE
2	Door Stops	1214H	613	TR
2	Door Sweeps	200 NDKB		NA
1	Saddle Threshold	426 BR MS/EA	613	NA
*2	Door Position Switches	MC4		DM

Gaskets by door manufacturer. Verify threshold application.

SET #22 - Fire Riser

Door: 131A

3	Hinges	CB199 4 1/2 X 4 1/2 NRP	630	ST
1	Lockset	9K3-7D15D PATD	626	BE
1	Closer/Stop	HD7016 SDS	689	BE
1	Kick Plate	K0050 10" x 2" LDW B4E CS	630	TR
1	Gasketing	700 NA SMS-TEKS		NA
1	Door Sweep	200 NA SMS-TEKS		NA
1	Saddle Threshold	426 SSMS/ES		NA
*1	Door Position Switch	MC4		DM

Do not cut weatherstrip - template hardware accordingly. Verify threshold application.

* Requires electronic coordination

End of Section 08 71 00

SECTION 08 71 13 – AUTOMATIC DOOR OPERATORS

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 types of automatic door operators:
 - 1. Low-energy door operators for swinging doors.
- B. Related Sections:
 - 1. Division 7 Sections for caulking to the extent not specified in this section.
 - 2. Division 8 Sections for “Aluminum-Framed Entrances and Storefronts” for entrances furnished and installed separately in Division 8 Section.
 - 3. Division 8 Section “Door Hardware” for hardware to the extent not specified in this section.
 - 4. Division 8 Section “Glazing” for materials and installation requirements of glazing for automatic entrances.
 - 5. Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance operators and access-control devices.

1.3 REFERENCES

- A. References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. CUL – Approved for use in Canada.
 - 4. NFPA 70 - National Electrical Code.
 - 5. NFPA 80 - Fire Doors and Windows.
 - 6. NFPA 101 - Life Safety Code.
 - 7. NFPA 105 - Installation of Smoke Door Assemblies.
- B. American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA).
 - 1. ANSI/BHMA A156.19 Standards for Power Assist and Low Energy Power Operated Doors.
- C. Underwriters Laboratories (UL).
 - 1. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - 2. UL 325 - Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- D. American Association of Automatic Door Manufacturers (AAADM).
- E. American Society for Testing and Materials (ASTM).
 - 1. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
 - 2. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.

- F. American Architectural Manufacturers Association (AAMA).
 - 1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- G. National Association of Architectural Metal Manufacturers (NAAMM).
 - 1. Metal Finishes Manual for Architectural Metal Products.
- H. International Code Council (IBC).
 - 1. IBC: International Building Code Building Code.

1.4 DEFINITIONS

- A. Activation device: Device that, when actuated, sends an electrical signal to the door operator to initiate the door operation.
- B. Monitored Safety Devices: A tested system that works in conjunction with the automatic door control that detects the presence of a person or an object within a zone where contact could occur and provides a signal to stop the movement of the door.
- C. AAADM: American Association of Automatic Door Manufacturers.
- D. Operating ambient Temperature Range: 5 Degrees F to plus 122 degrees F (minus 15 C to 50 degrees C).
- E. For automatic door terminology, refer to ANSI/BHMA A 156.19 for definitions of terms.

1.5 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic doors that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturers corresponding systems.
- B. Compliance:
 - 1. ICC/IBC International Building Code
 - 2. ANSI/BHMA A 156.19 American National Standard for Power Operated Doors Pedestrian Doors.
 - 3. UL 325 Listed
 - 4. NFPA 70 National Electrical Code.
 - 5. NFPA 101 Life Safety Code
 - 6. CUL Approved for use in Canada
 - 7. UL Listed Fire Door Operator with Automatic Closer
- C. Automatic Door equipment accommodates medium to heavy pedestrian traffic.
- D. Opening Force Requirements:
 - 1. Power-Operated swinging doors shall open with a manual force not to exceed 30 lbf (133N) to set the door in motion and 15 lbf to fully open the door with force applied at 1" (25mm) from the latched edge of the door. The required force to prevent a stopped door from opening or closing shall to exceed 15 lbf (67N) measured 1" (25mm) from the latch edge of the door at any point during the opening or closing.
- E. Closing Time:
 - 1. Door operators shall be field adjustable to close 90 degrees to 10 degrees in 3 seconds or longer per ANSI/BHMA A 156.19 standard.

2. Door shall be field adjusted to close from 10 degrees to fully closed position in not less than 1.5 seconds.

1.6 SUBMITTALS

- A. Comply with Division 01 – Submittal Procedures.
- B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles fabrication, operational descriptions and finishes.
- C. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, additional accessories and attachments to other work.
- D. Samples: color samples of exposed finish as required.
- E. Informational Submittals: Manufacturers product information and applicable sustainability program credits that are available towards a LEED rated product certification.
 1. Credit MR 4.1 and 4.2: Manufacture's or fabricator's certificate indicating percentage of post-consumer recycled content by weight and pre-consumer recycled content by weight for each product specified under this section.
- F. Manufacturers Field Reports: Submit manufacturer's field reports from AAADM certified technician of inspection and approval of doors for compliance with ANSI/BHMA A 156.19 after completion of installation.
- G. Operating and Maintenance Manuals: Provide manufacturers operating, owners and maintenance manuals for each item specified as required in Division 01, Closeout Submittals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: 10 years minimum of documented experience in manufacturing door equipment similar to that indicated within this specification with a proven record of successful service performance. A manufacturer with company certificate issued by AAADM.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 5 years documented experience installing and maintenance of units similar in material, design, and extent to that indicated in this specification and whose work has resulted in construction with a record of successful in-service performance. Manufacturer's authorized representative who is trained and approved for installation and maintenance of units by AAADM required for this Project
- C. Source Limitations for Automatic Operators: Obtain each type of automatic door operator and sensor components specified in this section from single source from single manufacturer.
- D. 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.
- E. Power-Operated Door Standard: ANSI/BHMA A 156.19 Current year.
- F. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings to receive automatic entrances by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate door operators with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of project.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic power door operator with connections to power supplies and access-control system.

1.10 WARRANTY

- A. Automatic Door Operators to be free of defects in material and workmanship for a period of One (1) year from the date of substantial completion.
- B. During the warranty period a factory trained technician shall preform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form submitted to the owner.
- C. During the warranty period all warranty work shall be performed during normal working hours.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. dormakaba • Reamstown, PA • 1-844-SPEC-NOW (1-844-773-2669) • Website: www.dormakaba.us • Email: specnow@dorma.com
- B. Substitutions: Requests for substitution and product approval in compliance with the specification must be submitted in writing and in accordance with the procedures outlined in Division 1, Section "Substitution Procedures". Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 AUTOMATIC SWING DOOR OPERATOR

- A. Model: DORMA, ED Series ED250 (Basis of Design) An Integrated, self-learning automatic swing door operator with an advanced CPU, a multistage gearbox with real time adaptive software and available user interface.
 - 1. Automatic Door Configuration:
 - a. Configuration: pair of doors swinging.
 - b. Traffic Pattern: two-way
 - c. Mounting: Surface applied
- B. Control Features
 - 1. Power-hold Close
 - 2. Built in Lock Delay
 - 3. On-Off-Hold Open switch control to control door function, (Automatic-Hold Open- Exit Only)

4. On-Off Power Switch
5. Fire Alarm Integration
6. Field Adjustable Handing
7. Push and Go
8. Power Assist Opening Activation
9. Intergraded Connections for Monitored Safety Sensors and other accessories.
10. Integrated access control

C. Door Control Features

1. Wind Load and Stack Pressure microprocessor monitored with power boost to ensure secure opening and closing in changing conditions.
2. Door Weight Max. ED 250 600 lbs.

D. Header Size: Fine header height at 2 3/4" by 5" 1/8" depth.

2.3 ACTIVATION DEVICES.

A. Activation Device:

1. Push Plate: Hard wired, 4-3/4 inch square stainless steel push plate engraved with "Push to Open" with a handicap logo, mounted on post.
2. Push Plate: Jamb mounted, hard wired, 1-1/2 inch x 4-3/4 inch, stainless steel push plate switches engraved with "Push to Open" with a handicap logo.
3. BR3 relay required to coordinate door opening

2.4 ELECTRICAL

- A. Electrical 115 V AC +/- 10% 50/60 Hz 6.6 A max.

2.5 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Anodized Finish:
1. Dark Bronze Anodic Finish: AAMA 611, AA-M12C22A44, Class I, 0.018 mm.

EXECUTION

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames with Installer present, for compliance with requirements for installation tolerances, wall and floor construction and other conditions affecting performance of automatic entrances.
- B. Examine roughing in for electrical source power to verify actual locations of wiring connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely 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.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections
- D. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide seal between the operator housing and wall surface. installation.
- E. Signage: Apply signage on both sides of each door and each sidelight as required by ANSI/BHMA A 156.19

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's representative shall provide technical assistance and guidance for installation of automatic doors.
 - 1. Factory trained and AAADM certified representative shall test and inspect each automatic door to determine compliance of the installed system to ANSI/BHMA A 156.19

3.4 ADJUSTING

- A. Adjust door operators and controls for smooth and safe operation.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by automatic operator installation promptly after installation .

3.6 DEMONSTRATION

- A. Engage a factory authorized representative to train Owner's maintenance personnel to adjust, operate, and maintain safe operation of automatic entrances.

END OF SECTION 087113

SECTION 088000 - GLAZING

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Storefront framing.
 - 4. Curtain wall framing.
 - 5. Interior borrowed lites.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - b. Exposure Category: As indicated of Drawings.

3. Design Snow Loads: As indicated on Drawings.
4. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
5. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
 - b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
 - c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
6. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
7. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
8. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass the following products; 12-inches square.
 1. Insulating glass.
- C. Glazing Accessory Samples: For gaskets and colored spacers, in 12-inch lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, and glazing gaskets.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Source Limitations for Glass: Obtain coated float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

- F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F .

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
- B. 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. Heat soaking required at tempered glass.
- C. 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. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. 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.
 - 4. 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.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following, and compatible with silicone glazing sealants
 - 1. Neoprene complying with ASTM C 864,
 - 2. Silicone complying with ASTM C 1115.
 - 3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.5 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. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.7 MONOLITHIC-GLASS TYPES

- A. Glass Type GL-1 at interior conditions: Clear float glass and fully tempered float glass (where indicated to be tempered).
 - 1. Thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.

2.8 INSULATING-GLASS TYPES

- A. Glass Type GL-2 at exterior conditions: Low-e-coated, clear insulating glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: 6.0 mm.
 - 3. Outdoor Lite: Float glass and Fully tempered float glass (where indicated to be tempered).
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Float glass and Fully tempered float glass (where indicated to be tempered).
 - 6. Low-E Coating: Pyrolytic on second surface.
 - 7. Visible Light Transmittance: 70 percent minimum.
 - 8. Winter Nighttime U-Factor: .29 maximum.
 - 9. Summer Daytime U-Factor: .27 maximum.
 - 10. Solar Heat Gain Coefficient: .39 maximum.
 - 11. Provide safety glazing labeling.
 - 12. Glass spacer shall be aluminum or stainless steel
 - 13. Primary and secondary seal to be polyisobutylene and silicone.
- B. Glass Type GL-3 at interior locations: clear insulating glass.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Each Glass Lite: 6.0 mm.
 - 3. Interspace Content: Air.

4. Indoor Lite: Float glass and Fully tempered float glass (where indicated to be tempered).
5. Visible Light Transmittance: 70 percent minimum.
6. Winter Nighttime U-Factor: .29 maximum.
7. Summer Daytime U-Factor: .27 maximum.
8. Solar Heat Gain Coefficient: .39 maximum.
9. Provide safety glazing labeling.
10. Glass spacer shall be aluminum or stainless steel
11. Primary and secondary seal to be polyisobutylene and silicone.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, 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 lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to 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 where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. 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.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a 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 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- 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.

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage 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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.
- F. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 088000

SECTION 088300 - MIRRORS

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Film-backed glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these

locations to project site for products extracted and manufactured within 100 miles of the project site.

- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
- D. Glazing Publications: Comply with the following published recommendations:
 - 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- E. Safety Glazing Products: For film-backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining

and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
 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. Avalon Glass and Mirror Company.
 - b. Head West.
- B. Clear Glass: Mirror Select Quality.
 1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 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. Laurence, C. R. Co., Inc.
 - b. Liquid Nails Adhesive.
 - c. Macco Adhesives.
 - d. OSI Sealants; Henkel Corporation.
 - e. Palmer Products Corporation.
 - f. Pecora Corporation.
 - g. Royal Adhesives & Sealants.
 - h. Sommer & Maca Industries, Inc.
 2. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 MIRROR HARDWARE

- A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.05 inch (1.3 mm).
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.062 inch (1.57 mm).
 - 3. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

- A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.
- B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Rounded polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION – 09 29 00
GYPSUM BOARD

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
 - 3. Trim accessories, joint treatment and auxiliary materials including acoustic insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.

- b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD 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 paper-faced gypsum panels 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 PERFORMANCE REQUIREMENTS

- 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.
- B. 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.
- C. LEED Performance Requirements:
 - 1. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide 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. 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. American Gypsum
- 2. CertainTeed Corporation
- 3. Georgia-Pacific Building Products.
- 4. USG Corporation.

- B. Gypsum Board: ASTM C 1396/C 1396M.

- 1. Thickness: 5/8 inch, Type X.
- 2. Long Edges: Tapered.
- 3. Mold and moisture resistant where indicated

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Tile Backing Panels. ASTM C1178.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed; Diamondback Tile Backer Type X
 - b. Georgia-Pacific Building Products: Densshield Tile Backer.
- 2. Core: 5/8 inch, Type X.
- 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

- 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
- 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. F-Reveal: exposed long flange receives joint compound
 - d. Expansion (control) joint.
- 3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 , Alloy 6063-T5.
- 4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 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.
 - 2. All screws to be non-corrosive type for use in wet environments. Use stainless steel drill screws or other approved screws at gypsum board products installed between grids D and J and 13 and 28 on the first floor, and between grids D and G and 15 and 25 on the second floor. For fastening gypsum backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Hilti, Inc; CP 506 Smoke and Acoustical Sealant.
 - d. Pecora Corporation; AC-20 FTR
 - e. Specified Technologies, Inc; Smoke N Sound Acoustical Sealant.
 - f. USG Corporation; SHEETROCK Acoustical Sealant.

- E. Vapor Retarder Membrane: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, 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.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

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. 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.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. 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.
- G. 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.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- L. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: As indicated on Drawings.
 - 2. Moisture- and Mold-Resistant Type: install in Room 108 where tile backer panels are not required.
 - 3. Gypsum Tile Backer Panels: install at wall tile locations, unless otherwise noted.
- 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) or horizontally (perpendicular 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 ceilings, apply gypsum board indicated for base layers before applying face layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. 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.

3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

- A. 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. 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. F-Reveals: Use at wall bases where indicated in drawings.

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 and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for acoustical tile and back-of-house areas such as mechanical rooms, pool mechanical rooms, electrical rooms, and elevator machine rooms.
 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 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.
- D. CLEANING
 - 1. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 09 29 00

SECTION 093013 - CERAMIC TILING

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. Ceramic tile
 - 2. Aluminum cove strips
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for glass-mat, water-resistant tile backer board.
 - 3. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

DEFINITIONS

- C. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- D. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- E. Module Size: Actual tile size plus joint width indicated.
- F. Face Size: Actual tile size, excluding spacer lugs.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference remotely or at project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 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. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 36 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as 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.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

1.9 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 requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. LEED Performance Requirements:
 1. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 2. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.
 3. Flooring: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
 4. Floor Coatings: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later and meet the applicable VOC content limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, Section 01 35 15 – LEED Certification Procedures.

1.10 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish 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 single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, 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.
- D. 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 swimming pools or 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.

2.3 TILE PRODUCTS

- A. Wall Tile Type A: Porcelain tile, mosaic
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Trek Anthrocite Wall Mosaic Wall B 12"x24" or approved equal product by one of the following:
 - a. Thompson Tile
 - b. American Marazzi Tile, Inc.

- c. American Olean; a division of Dal-Tile Corporation.
 - d. Daltile.
 - e. Grupo Porcelanite.
 - f. Jeffrey Court Inc.
 - g. Seneca Tiles, Inc.
 2. Module Size: 12"x24"
 3. Thickness: .35"
 4. Tile Color: Anthrocite
 5. Grout Color: TBD- as selected by Architect from manufacturer's full range.
 6. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
 - a. Internal Corners: Field-buttet square corners.
- B. Wall Tile Type B: Glazed ceramic tile, single color, gloss
 1. Basis-of-Design Product: Subject to compliance with requirements, provide DalTile Natural Hues 3x9 Floor Tile or comparable product by one of the following:
 - a. Thompson Tile
 - b. American Marazzi Tile, Inc.
 - c. American Olean; a division of Dal-Tile Corporation.
 - d. Daltile.
 - e. Grupo Porcelanite.
 - f. Jeffrey Court Inc.
 - g. Seneca Tiles, Inc.
 2. Module Size: 3"x9"
 3. Thickness: nominal 5/16"
 4. Finish: Plain gloss
 5. Tile Color: QH63 Pearl White
 6. Grout Color: TBD - as selected by Architect from manufacturer's full range.
 7. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
 - a. External Corners for Thinset Mortar Installations: Surface bullnose
 - b. Internal Corners: Field-buttet square corners.
- C. Floor Tile Type 1: Porcelain tile, mosaic
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Trek Anthrocite Wall Mosaic Wall B 12"x24" or approved equal product by one of the following:
 - a. Thompson Tile
 - b. American Marazzi Tile, Inc.
 - c. American Olean; a division of Dal-Tile Corporation.
 - d. Daltile.
 - e. Grupo Porcelanite.
 - f. Jeffrey Court Inc.
 - g. Seneca Tiles, Inc.
 2. Module Size: 12"x24"
 3. Thickness: .35"
 4. Tile Color: Anthrocite
 5. Grout Color: TBD- as selected by Architect from manufacturer's full range.

6. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
 - a. Internal Corners: Field-buttet square corners.

2.4 ALUMINUM BASE COVES

- A. Cove Type 1: For use at locations where floor tile is present.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter Dilex-AHK.

2.5 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
 3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F , respectively, and certified by manufacturer for intended use.

2.6 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3.
 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F , respectively, and certified by manufacturer for intended use.

2.7 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. Waterproofing / Crack Isolation Membrane: (noted as "waterproof membrane" drawings):
 - 1. RedGard by Custom Building Products, or equal
 - a. RedGard as Waterproof Membrane:

1 Gallon (3.78 L)	55 sq. ft. (5.1 M2)
3.5 Gallon (13.2 L)	192 sq. ft. (17.8 M2)
- C. Vapor-Retarder / Cleavage Membrane (noted as "cleavage membrane" on drawings):
 - 1. Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- 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 and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bonsal American, an Oldcastle company
 - b. Custom Building Products
 - c. Jamo Inc
 - d. Southern Grouts & Mortars, Inc.
 - e. Summitville Tiles, Inc
 - 2. Grout sealers shall comply with requirements of FloorScore certification.

2.8 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 the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

- b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. 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.
 - 4. 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. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped toward drains. Refer to drawings for slope direction and inches / foot.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Install waterproof membrane as required by manufacturer. Fill all holes more than 1/8" before starting. Lightly dampen all porous surfaces. Heavily precoat the corners and intersections of wall to floor, and tops of partial height walls, and on top of framing for locker bases, and extend minimum 6" on both sides, and embed a 6" wide fiberglass mesh into the membrane at all corners/intersections. Apply at a rate of 55 sf/gallon for each coat. Apply 2 coats with drying time per manufacturer. Take photos between installations.
- C. General Contractor approval of waterproofing of all surfaces required before proceeding to tile.
- D. 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.
- E. 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.
- F. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

- G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. 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.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- H. Joint Widths: As recommended by tile manufacturer.
- I. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or, if not indicated, above joints in concrete substrates. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
- K. 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 from tile faces by wiping with soft cloth.
- L. Metal Edge Strips: Install at joint between thickset floor tile and adjacent floor finishes, unless otherwise shown.
- M. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.
- N. Sealant: Install continuous sealant at top of edge tile and at tile/GWB joints. Install continuous sealant at the wall to wall intersections.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. 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.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Slab on Grade:
 - 1. Ceramic Tile Installation - thickset floor tile: TCNA F114 and ANSI A108.1C; cement mortar bed (thickset) with cleavage membrane; epoxy grout.
 - a. Pre-slope mortar bed
 - b. Waterproof Membrane
 - c. Ceramic Tile, refer to finish schedule.
 - d. Bond Coat for Cured-Bed Method: Latex- portland cement mortar.
 - e. Grout: Water-cleanable epoxy grout.
- B. Interior Wall Installations, Metal Studs or Furring:
 - 1. Ceramic Tile Installation: TCNA W243, thinset mortar on gypsum backer boards, with waterproof membrane over backer board.
 - a. Pre-slope mortar bed
 - b. Waterproof Membrane
 - c. Ceramic Tile, refer to drawings.
 - d. Thinset Mortar: Latex-portland cement mortar.
 - e. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION – 09 51 23
ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for ceilings.
- B. Related Requirements:
 - 1. Section 098433 "Sound Absorbing Wall Units" for acoustic panels.
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
 - 2. Exposed Moldings and Trim: Set of 6-inch-long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling direct attach-system members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 5. Minimum Drawing Scale: 1/8 inch = 1 foot.
- B. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.8 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. Acoustical Ceiling Units: Full-size tiles equal to 5 percent of quantity installed.

1.9 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, direct attach-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 tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 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.
- C. LEED Performance Requirements
 - 1. Ceiling Systems: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
 - 2. Ceiling Systems: Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3. Ceiling Systems: Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 ACOUSTICAL TILES, GENERAL

- A. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.
- C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
- D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL TILES: ACT-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ultima or comparable product by one of the following:
1. United States Gypsum Company
 2. Certainteed
 3. Other approved equal.
- B. Color: White.
- C. NRC: Not less than 0.70.
- D. CAC: Not less than 35.
- E. Edge/Joint Detail: Beveled Tegral, 9/16".
- F. Thickness: 3/4 inch (19 mm).
- G. Modular Size: 24" x 24."
- H. Edge Molding: Armstrong Shadow Reveal Transition Molding (size coordinated with grid system) or equal.
- I. Location: All ACT locations other than Kitchen.

2.1 ACOUSTICAL TILES: ACT-2

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceramaguard 605 or comparable product by one of the following:
1. United States Gypsum Company
 2. Certainteed

- 3. Other approved equal
- B. Color: White.
- C. CAC: Not less than 40
- D. Edge/Joint Detail: Straight, 15/16".
- E. Thickness: 3/4 inch (19 mm).
- F. Modular Size: 24" x 24".
- G. Location: Kitchen.

2.2 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, 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 according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. 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 three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.
- D. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
- E. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.3 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements Armstrong World Industries, USG Corporation or approved equal.
- B. For ACT-1: Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
 - 1. Structural Classification: Intermediate-duty system.

2.4 ACOUSTICAL SEALANT

- A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and 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.
 - 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

2.5 MISCELLANEOUS MATERIALS

- A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- 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 to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. 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.
 7. 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.
 8. Do not attach hangers to steel deck tabs.
 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 tile ceiling area and where necessary to conceal edges of acoustical tiles.
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 o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. 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. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.

3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
4. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- B. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 09 51 23

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
 - 2. Resilient molding accessories.
- B. Related Requirements:
 - 1. Section 096813 "Tile Carpeting" for carpet tile.
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 4 inches long.
- D. Product Schedule: For resilient base and accessory products.

1.4 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. Furnish not less than 10 linear feet (3 linear m) for every 300 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply

with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.

3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Coordinate mockups in this Section with mockups specified in other Sections.

1.7 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).

1.8 FIELD CONDITIONS

- A. Maintain ambient 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 resilient products during the following time periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermoset-Rubber Base and Accessories: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 THERMOSET-RUBBER BASE – RUBBER BASE

- A. 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. Flexco.
 - 2. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style B, Cove
- C. Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Colors: To be selected from manufacturer's standards.

2.3 RUBBER MOLDING ACCESSORY

- A. 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. Roppe Corporation, USA.
 - 2. VPI Corporation.
- B. Description: cap for cove resilient flooring, edge guards for resilient flooring, and edge guards for carpet
- C. Profile and Dimensions: To be verified.

- D. Locations: Provide rubber molding accessories in areas indicated.
- E. Colors: To be selected from manufacturer's standards.

2.4 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

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 resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Provide continuous silicone sealant at the base of gypsum drywall panels and cabinets, prior to installation of resilient base.
- C. Apply resilient base to walls, casework, and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Do not apply to columns.
- D. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

- E. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- F. Do not stretch resilient base during installation.
- G. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- H. Preformed Corners: Install preformed corners before installing straight pieces.
- I. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

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 floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
- 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. Cover resilient products subject to wear and foot traffic until Substantial Completion. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 096513

0SECTION 096516 - RESILIENT SHEET 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. Rubber sheet flooring with backing
 - 2. Vinyl Sheet Flooring at Kitchen
 - 3. Luxury Vinyl Tile Flooring
 - 4. Adhesives

- B. Related Requirements:

- 1. Section 033000 "Cast in Place Concrete"
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.1 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For each type of resilient sheet flooring.

- 1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.

- C. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

- D. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.

- 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

- E. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.2 INFORMATIONAL SUBMITTALS

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.5 LEED SUBMITTALS

- a. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1) LEED Submittal Coversheet
 - 2) Low-Emitting Materials Submittals:
 - a) EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3) Materials and Resources Submittals:
 - a) MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - (1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c) MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet 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 rolls upright.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F , in spaces to receive resilient sheet flooring during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 RUBBER SHEET FLOORING WITH BACKING - noted as RES-1 on drawings

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ECOsurfaces classic 3mm with ECO comfort 5mm backing by Ecore
- B. Product Standard: ASTM F 1860.
 - 1. Type: Type I, homogeneous rubber sheet floor covering with backing.
 - 2. Wear-Layer Thickness: As standard with manufacturer .
 - 3. Overall Thickness: 8 mm (3mm + 5mm).
 - 4. Interlayer Material: As standard with manufacturer.
 - 5. Backing: Foamed rubber.
 - 6. Combined Hardness: Not less than required by ASTM F 1860 .
- C. Sheet Width: As standard with manufacturer.
- D. Seamless-Installation Method: Heat welded.
- E. Colors and Patterns: Caution Tape (or comparably priced color as selected by the architect).

2.3 UNBACKED VINYL SHEET FLOORING - noted as RES-2 on drawings

- a. Products: Subject to compliance with requirements, provide the following, or an approved equal by another manufacturer.
 - 1) Altro Designer 25
- b. Thickness: 2.5mm.
- c. Wearing Surface: Slip-resistant, with quartz crystals.
- d. Sheet Width: As standard with manufacturer.
- e. Seamless-Installation Method: Heat welded.
- f. Cove base
- g. Color: To be selected from manufacturer's full range of colors.

2.4 LUXURY VINYL TILE FLOORING - noted as RES-3 on drawings

- a. Products: Subject to compliance with requirements, provide the following, or an approved equal by another manufacturer.
 - 1) ShawContract Terrain II LVT
- b. Style: Terrain II
- c. Size = 6" x 48" plank tile
- d. Construction: Heavy Duty Commercial Luxury Vinyl Tile
- e. Type LVT
- f. Overall Thickness: 3mm.
- g. Wearing Layer Thickness: 30 mil.
- h. Installation: Direct Glue.
- i. Color: To be selected from manufacturer's full range of colors.

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 resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

- a. Colors: As selected by Architect from manufacturer's full range to contrast with flooring .
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet 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 resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet 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 resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. 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.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- 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 resilient sheet flooring until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet 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.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

1.1 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.

- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient sheet flooring until Substantial Completion.
- E. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 096516

SECTION 096813 - TILE CARPETING

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 modular, fusion-bonded carpet tile and carpet tile walk-off mat.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. .

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, 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. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 CARPET TILE #1 - noted as CARPET 1 on drawings

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Shaw Contract, Current Tile** (5T350): Journey or comparable approved product by other manufacturers.
- B. Color: As selected from Manufacturer's Standard Line
- C. Pattern: Match Architect's samples.
- D. Size: 9"x36" plank tile.

2.3 CARPET TILE 2# - noted as WALK-OFF MAT on drawings

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Step Up Tile II Walk-Off Mat Tile by Mohawk Group**, or comparable approved product by other manufacturers. Products install in recessed slab, refer to plans.
- B. Color: As selected by Architect from manufacturer's full range.
- C. Size: from manufacturer's standard tile sizes.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, 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.

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.

- 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 bond and moisture tests 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "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, 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 CRI 104, Section 14, "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.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- 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. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, 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 CRI 104, Section 16, "Protecting Indoor Installations."
- C. 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.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 096813

SECTION 098433 - SOUND-ABSORBING WALL UNITS

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.
- B. Related Requirements
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing ceiling baffles.
 - 2. Sound-absorbing wall panels

1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
- C. Samples for Verification: For the following products:
 - 1. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
 - 2. Core Material: 12-inch- square Sample at corner.
 - 3. Mounting Devices: Full-size Samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of unit.
- B. Sample Warranty: For manufacturer's special warranty.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard(CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include manufacturers' written cleaning and stain-removal instructions.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.

- b. Warping of core.
- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.
- B. LEED Performance Requirements:
 - 1. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2. Products proposed for substitution must also be FSC certified wood products.
 - 3. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.3 SOUND-ABSORBING CEILING BAFFLES

- A. Sound-Absorbing Acoustic Ceiling Baffles: Manufacturer's standard baffle construction.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide AUTEX Cube ceiling baffles.
 - 1. Provide basis of design products or comparable approved products.
 - a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.
- C. Core Material: Compressed Polyester Felt.
 - 1. Acoustical Performance: Sound absorption NRC of according to ASTM C 423 for Type C mounting according to ASTM E 795.
 - 2. Edge Profile: Beveled.
 - 3. Nominal Overall Panel Thickness: 1 inch.
 - 4. Panel Width: 8'.
 - 5. Panel Height: 1'.
 - 6. Mounting: Suspended.
 - 7. Color: TBD

2.4 SOUND-ABSORBING WALL PANELS

- A. Sound-Absorbing Acoustic Wall Panels: Manufacturer's standard wall panel construction.

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **AUTEX Cascade wall panels.**
2. Provide basis of design products or comparable approved products.
- a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.
- C. Core Material: Compressed Polyester Felt.
1. Acoustical Performance: Sound absorption NRC of according to ASTM C 423 for Type C mounting according to ASTM E 795.
 2. Edge Profile: Beveled.
 3. Nominal Overall Panel Thickness: 1 inch.
 4. Panel Width: 8'.
 5. Panel Height: 4'.
 6. Mounting: Surface applied.
 7. Color: TBD
 8. Pattern: CNC cut, architect to supply vector file

2.5 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated.
- B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.
 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sound-absorbing wall units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

1.1 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/16-inch variation from hairline in 48 inches, noncumulative.

1.2 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 098433

SECTION – 09 91 23
INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum board.
 - 2. Acoustic panels.
 - 3. Cotton or canvas insulation covering.
 - 4. ASJ insulation covering.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming and powder coating metal fabrications.
 - 3. Section 099600 "High-Performance Coatings" for CMU and steel coatings.
 - 4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on wood substrates.
 - 5. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.

2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
1. LEED Submittal Coversheet
 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.7 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

- a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
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 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.9 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later and meet the applicable VOC content limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, Section 01 35 15 – LEED Certification Procedures.
- B. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation
2. Benjamin Moore & Co
3. Kelly-Moore Paint Company Inc.
4. PPG Architectural Coatings.
5. Rodda Paint Co.
6. Sherwin-Williams Company (The)

- B. Products: Subject to compliance with requirements, provide product listed in the Interior Painting Schedule for the paint category indicated.

2.3 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: Match Architect's samples.
1. Up to thirty percent of surface area will be painted with deep tones.

2.4 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.
- F. Verify products have been stored, and will be installed, in accordance with
- G. project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 1. SSPC-SP 3 for steel not exposed to view to the public.
 2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for steel exposed to view to the public
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- E. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.6 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates – low gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
- B. Steel Substrates – semi gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
- C. Galvanized-Metal Substrates – low gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
- D. Galvanized-Metal Substrates – semi-gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

- E. Gypsum Board and Plaster Substrates - low gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
- F. Gypsum Board and Plaster Substrates - semi-gloss, refer to drawings for locations
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.
- G. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings
 - 1. Institutional Low-Odor/VOC Latex System MPI INT 10.1D:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

END OF SECTION – 09 91 23

SECTION – 09 93 00
STAINING AND TRANSPARENT FINISHING

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 surface preparation and application of wood stains and transparent finishes on the following substrates:
 - 1. Exterior Substrates:
 - a. Wood-based panel products, including new glu-lam beams, wood decking, and peeler poles.
 - 2. Interior Substrates:
 - a. Wood-based panel products including, including new glu-lam beams, wood decking, and peeler poles.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting"
 - 2. Section 099600 "High-Performance Coatings"
 - 3. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 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. Stains and Transparent Finishes: 5 percent, but not less than 2 gallons of each material and color applied.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.
 - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later and meet the applicable VOC content limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, Section 01 35 15 – LEED Certification Procedures.

2.2 MANUFACTURERS

- A. 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in wood finish systems schedules or comparable products by one of the following:
 1. Behr Process Corporation
 2. Benjamin Moore & Co.
 3. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 4. Kelly-Moore Paint Company Inc.
 5. Parker Paint; Comex Group.
 6. Rodda Paint Co.
 7. Sherwin-Williams Company (The).
- C. Products: Subject to compliance with requirements, provide product meeting MPI standards listed in wood finish systems schedules for the product category indicated.

2.3 MATERIALS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Stain Colors: To be determined.

2.4 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.
- B. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- C. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 1. Use applicators and techniques suited for finish and substrate indicated.
 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

- E. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management

END OF SECTION – 09 93 00

SECTION – 09 96 00
HIGH-PERFORMANCE COATINGS

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 surface preparation and the application of high-performance coating systems on the following substrates:

- 1. Exterior Substrates:
 - a. Steel.
 - b. Galvanized metal.
 - c. Concrete masonry units.
- 2. Interior Substrates:
 - a. Steel.
 - b. Galvanized metal.
 - c. Concrete masonry units.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
- 2. Section 099113 "Exterior Painting" for general field painting.
- 3. Section 099123 "Interior Painting" for general field painting.
- 4. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 LEED SUBMITTALS

A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

1.7 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. .
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.9 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F .
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Interior Coatings Applied On-Site: Meet emissions testing and requirements of CDPH Standard Test Method v1.1-2010 or later and meet the applicable VOC content limits of the California Air Resources Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011, Section 01 35 15 – LEED Certification Procedures.

2.2 MANUFACTURERS

- A. 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. Behr Process Corporation
 2. Benjamin Moore & Co
 3. Kelly-Moore Paint Company Inc.
 4. PPG Architectural Coatings.
 5. Rodda Paint Co.
 6. Sherwin-Williams Company (The)
 7. TNEMEC

2.3 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: Match Architect's samples.

2.4 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.
- D. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer. but not less than the following:
 - 1. SSPC-SP 3 for steel not exposed to view to the public.
 - 2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for steel exposed to view to the public
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
- E. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel Substrates – gloss, refer to drawings for locations
 - 1. Epoxy System MPI EXT 5.1F:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
 - c. Topcoat: Epoxy, gloss, MPI #77.
- B. Steel Substrates – low gloss, refer to drawings for locations
 - 1. Epoxy System MPI EXT 5.1F:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
 - c. Topcoat: Epoxy, low gloss, MPI #108.

C. Galvanized-Metal Substrates – gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.3C:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.

D. Galvanized-Metal Substrates – low gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.3C:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, low gloss, MPI #108.
 - F. Concrete Substrates – anti graffiti and sealer coating

E. Concrete and Concrete Masonry Unit Substrates – anti graffiti and sealer coating

1. Fabrishield Paint Repellent PR 60. Prep and apply per manufacturer's written instructions. Avoid excessive flooding which can lead to surface deposition and unsightly darkening.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates - gloss, refer to drawings for locations

1. High-Build Epoxy over Epoxy Zinc-Rich Primer System MPI INT 5.1P:
 - a. Prime Coat: Primer, zinc-rich, epoxy, MPI #20.
 - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
 - c. Topcoat: Epoxy, high-build, gloss, MPI #77.

B. Steel Substrates – low gloss, refer to drawings for locations:

1. High-Build Epoxy over Epoxy Zinc-Rich Primer System MPI INT 5.1P:
 - a. Prime Coat: Primer, zinc-rich, epoxy, MPI #20.
 - b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
 - c. Topcoat: Epoxy, high-build, low gloss, MPI #108.

C. Galvanized-Metal Substrates: gloss, refer to drawings for locations

1. Epoxy over Epoxy Primer System MPI INT 5.3D:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.
 - c. Topcoat: Epoxy, gloss, MPI #77.

D. Galvanized-Metal Substrates: low gloss, refer to drawings for locations

1. Epoxy over Epoxy Primer System MPI INT 5.3D:
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - b. Intermediate Coat: Epoxy, matching topcoat.

c. Topcoat: Epoxy, gloss, MPI #108.

E. Concrete and Concrete Masonry Unit Substrates – anti graffiti and sealer coating

1. Fabrishield Paint Repellent PR 60. Prep and apply per manufacturer's written instructions. Avoid excessive flooding which can lead to surface deposition and unsightly darkening.

END OF SECTION – 09 96 00

SECTION – 10 10 00

MISCELLANEOUS SPECIALTIES

PART 1 – GENERAL

1.1 SCOPE OF WORK

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Indoor/Outdoor Fireplace
 - 2. Knox Box

PART 2 - PRODUCTS

2.1 INDOOR / OUTDOOR FIREPLACE

A. Basis of Design: Subject to compliance with requirements, provide Town & Country Luxury Fireplaces WS54ST Indoor/Outdoor gas fireplace. Substitutions will be considered in accordance with Section 012500 Substitution Procedures.

2.2 KNOX BOX

- A. Knox Box, Model #1404, Knox Elevator/Lobby Box, aluminum finish
 - 1. Install adjacent to door #131A with top at 48" above finished floor. Confirm with Fire Marshal prior to installation.
 - a. Burner: Long Beach Logset
 - b. Firebox Panel: Titanium

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

3.2 INSTALLATION

- A. Per drawing details and manufacturer's shop drawings.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION – 10 10 00

SECTION 101100 - VISUAL DISPLAY UNITS

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Tackboards.

1.3 DEFINITIONS

- A. Tackboard: unframed, tackable, visual display board, adhesive applied
- B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, without a perimeter frame; includes chalkboards, markerboards, and tackboards.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of panel joints.
- C. Samples for Verification: For each type of visual display surface indicated.
 - 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, 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 surfaces vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Tackboard: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed with integral color throughout. Particleboard: ANSI A208.1, Grade M-1., made with binder containing no urea formaldehyde.
- B. Fiberboard: ASTM C 208.

2.2 TACKBOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Forbo or approved equal
 - 2. Mounting Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.

2.4 VISUAL DISPLAY SURFACE SCHEDULE

- A. Tackboard

1. Corners: Square.
2. Width: As indicated on Drawings.
3. Height: As indicated on Drawings.
4. Mounting: Wall, adhesive
5. Mounting Height: As indicated on Drawings.
6. Edges: Exposed, cut edge
7. Color: As selected from Manufacturer's standard line.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Tackboard: Attach tackboard to wall surfaces with adhesive gobs at horizontal and vertical spacing recommended by manufacturer.
- C. 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.
- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 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.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 101100

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cast dimensional characters.
 - 2. Vinyl dimensional letters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least quarter scale.
- C. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include representative Samples of available typestyles.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Exposed Accessories: Full-size Sample of each accessory type.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cast Characters Metal: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 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. A.R.K. Ramos.
 - b. ACE Sign Systems, Inc.
 - c. ASI Sign Systems, Inc.
 - d. Cosco.
 - e. Gemini Incorporated.
 - f. Matthews International Corporation; Bronze Division.
 - g. Metal Arts.
 - h. Metallic Arts.
 - i. Southwell Company (The).

2. Character Material: Cast aluminum.
3. Character Height: As indicated.
4. Thickness: Manufacturer's standard for size of character.
5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - b. Overcoat: Clear organic coating.
6. Mounting: Concealed studs.
7. Typeface: To be selected from manufacturer's range of typestyles..

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 VINYL CHARACTERS

- A. Adhesive applied vinyl characters for building address applied to front entry glass. Confirm location with architect.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.
- C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils . Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Concrete Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

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. Panel signs.
- 2. Room-identification signs.

- B. Related Requirements:

- 1. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
- 2. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
- 3. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
- 4. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For panel signs.

- 1. Include fabrication and installation details and attachments to other work.
- 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
- 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size

- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Panel Signs: Not less than 12 inches square, including corner.
 - 2. Room-Identification Signs: Full-size Sample.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 SIGNS

- A. 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:

- B. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Allen Markings.
 - b. APCO Graphics, Inc.
 - c. Mohawk Sign Systems.
 - d. Seton Identification Products
 2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to manufacturer's standard backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Subsurface Graphics: Reverse halftone or dot-screen image. Image to be verified
 - c. Color(s): As selected by Architect from manufacturer's full range.
 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: As indicated.
 - b. Corner Condition in Elevation: As indicated.
 4. Mounting: Surface mounted to wall with two-face tape.
 5. Surface Finish
 - a. Overcoat: Manufacturer's standard baked-on clear coating.
 6. Text and Typeface:
 - a. Accessible raised characters and Braille and as indicated on drawings. Finish raised characters to contrast with background color, and finish Braille to match background color.
 - b. Typeface to be verified.
 - c. Text as indicated on drawings.
 7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
- C. Room-Identification Signs (those associated with doors to each room) and Building Accessibility Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Allen Markings.
 - b. APCO Graphics, Inc.
 - c. Mohawk Sign Systems.
 - d. Seton Identification Products

2. Laminated-Sheet Sign: Photopolymer face Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to manufacturer's standard backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Subsurface Graphics: Reverse halftone or dot-screen image. Image to be verified.
 - c. Color(s): As selected by Architect from manufacturer's full range.
3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: As indicated.
 - b. Corner Condition in Elevation: As indicated.
4. Mounting: Surface mounted to wall with two-face tape.
5. Text and Typeface:
 - a. Accessible raised characters and Braille and as shown on drawings. Finish raised characters to contrast with background color, and finish Braille to match background color.
 - b. Typeface to be verified
 - c. For bidding purposes, text to match name of room shown on schedule. Final text to be verified during the submittal process.

2.3 SIGN MATERIALS

- A. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Signs Mounted to Glass: provide blank panel at room-side, color to be verified, mount with two-face tape.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.
- C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- D. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 101423

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
 - 1. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1. LEED SUBMITTALS

- a. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program,

recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- (1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84, Class B; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: 75 or less.
 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.
- C. LEED Performance Requirements
 1. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Basis of Design is Scranton Products Eclipse line. Other equal products will be considered.
- B. Toilet-Enclosure Style: Overhead braced Floor anchored.
- C. Urinal-Screen Style: Wall hung .
- D. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels.
 1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.
 2. Panel and Door Height at Toilet Stalls: 66" high
 3. Panels at Urinal Screens: 18" wide by 48" high
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel aluminum.

G. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room
2. Color and Pattern: As selected from manufacturer's standard color line
3. Edge Color: Black core

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Clear-anodized aluminum, Stainless steel.
2. Hinges: Manufacturer's standard, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Refer to 102800 "Toilet and Bath Accessories.)
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.
- E. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 102113.17

SECTION 102239 - FOLDING PANEL PARTITIONS

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. Manually operated, acoustical panel partitions.
- B. LEED Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Textile Facing Material: Full width by not less than 36-inch-(914-mm-) long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches (75 mm) square.
3. Hardware: One of each exposed door-operating device.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems are attached.
 4. Plenum acoustical barriers.
- B. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- C. Field quality-control reports.

1.7 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 1. LEED Submittal Coversheet
 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
 - 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.
 - 3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for not less than the NIC rating indicated.

2.2 OPERABLE ACOUSTICAL PANELS – DINING ROOM

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hufcor Series 642 or comparable product by one of the following:
 - a. Advanced Equipment Corporation.
 - b. Modernfold, Inc.
 - B. Panel Operation: Manually operated, paired panels.
 - C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
 1. Panels shall have ½" gypsum wallboard and 18 ga. steel face construction.
 - D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 1. Panel Width: Standard widths.
 - E. STC: Not less than 51.
 - F. NRC: 20, verify with selection of fabric
 - G. NIC: Not less than 45
 - H. Panel Weight: 10.2 pounds maximum.
 - I. Panel Thickness: 4 inches
 - J. Panel Closure: Manufacturer's standard unless otherwise indicated.
 - K. Pocket Doors: Hufcor Type 1, or equal
 - L. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 1. Hinges: Manufacturer's standard.
- 2.3 SEALS
- A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 1. Manufacturer's standard seals unless otherwise indicated.
 2. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
 - B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.
 - C. Horizontal Top Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

- D. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

2.4 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal butted edges seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
 - 2. Where facings with directional or repeating patterns or directional weave are indicated, mark facing top and attach facing in same direction.
 - 3. Match facing pattern 72 inches (1830 mm) above finished floor.
- B. Fabric Wall Covering: Manufacturer's standard fabric, from same dye lot, treated to resist stains.
 - 1. Color/Pattern: As selected by Architect from manufacturer's full range.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
 - 1. Multidirectional Carriers: Capable of negotiating intersections without track switches.
- C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

- E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals. Perform test and make adjustments before NIC testing.
- G. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 FIELD QUALITY CONTROL

- A. NIC Testing: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing Extent: Testing agency shall test both operable panel partition installations.
 - 2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Verify that safety devices are properly functioning.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 102239

SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.
 - 2. Impact-resistant wall coverings.
- B. Related Sections:
 - 1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include 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.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches (300 mm) long.
 - 2. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.7 MATERIALS MAINTENANCE 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. Corner-Guard Covers: four, 4-foot long units.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
 2. Keep plastic sheet material out of direct sunlight.
 3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

- a. Store corner-guard covers in a vertical position.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures.
- b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 40 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

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. American Floor Products Co., Inc.
- b. Arden Architectural Specialties, Inc.
- c. Balco, Inc.
- d. Boston Retail Products.
- e. Construction Specialties, Inc.
- f. IPC Door and Wall Protection Systems; Division of InPro Corporation.
- g. Korogard Wall Protection Systems; a division of RJF International Corporation.

- h. Pawling Corporation.
 - i. Tepromark International, Inc.
 - j. WallGuard.com.
- 2. Material: Extruded aluminum, minimum 0.080 inch (1.6 mm) thick, with clear anodic finish.
- 3. Wing Size: Nominal 2-1/2 by 2-1/2 inches (65 by 65 mm).
- 4. Height: 4 feet.
- 5. Corner Radius: 1/8 inch (3 mm).
- 6. Mounting: Adhesive.

2.3 IMPACT-RESISTANT WALL COVERINGS (FRP)

- A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
- A. Manufacturers: Subject to compliance with requirements: Alpar Architectural Products, LLC, or approved equal.
 - 1. Size: As indicated.
 - 2. Sheet Thickness: 0.04 inch
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 4. Texture: Smooth
 - 5. Height: Full height (floor to ceiling) at rooms and walls indicated to receive FRP, unless otherwise shown on drawings.
 - 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - 7. Mounting: Adhesive.

2.4 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 3. Run grain of directional finishes with long dimension of each piece.
 - 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 24" (305 mm).
 - c. Adjust end and top caps as required to ensure tight seams.
- B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 102600

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

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. Toilet accessories, including coat hooks throughout building.
- B. Related Sections include the following:
 - 1. Division 9 Section "Ceramic Tile".
 - 2. Division 10 Section "Toilet Compartments" for compartments and screens.
 - 3. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

- B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
 - 1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
 - 2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Consultant for review.

1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required by ADA requirements ANSI 117.1 for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

- A. General Warranty: Provide 1 year warranty on all accessories from the date of Physical Completion. For mirrors, extend same warranty for 5 years total.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:
 - 1. Toilet and Bath Accessories:
 - a. Bobrick Washroom Equipment, Inc.
 - b. Bradley Corp.
 - c. American Accessories, Inc.
- B. Products: Subject to compliance with requirements, provide products indicated for each designation in the Toilet and Bath Accessory Schedule at the end of Part 3 and the drawings.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

- D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- E. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

- A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
 - 1. Provide galvanized steel backing sheet, not less than 0.034 inch (0.85 mm) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
 - 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - 2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. For items not shown specifically in the drawings, field verify locations with Project Engineer. 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

- C. Provide solid blocking in walls for securing all accessories.
- D. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.
- E. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

- A. Combo Paper Towel Dispenser and Waste Receptacle: Provide (1) surface mounted paper towel dispenser in each of the following rooms: 108, 109, 112, and 122. Provide (2) surface mounted paper towel dispenser in each of the following rooms: 116 and 117.
 - 1. Products: Bobrick B-3974 Classic Series Recessed Convertible Automatic, Universal Roll Towel Dispenser Equipped with LED Light / Waste Receptacle with conversion kit for hard-wired connection or approved equal.
- B. Surface Toilet Tissue Dispenser: Provide toilet tissue dispenser at each toilet and complying with the following:
 - 1. Bobrick B-27460 – 2-roll toilet tissue dispensers or approved equal. Mount under the grab bars to meet ADA code.
- C. Surface Mounted Toilet Seat Cover Dispenser: Provide seat cover dispenser at each toilet and complying with the following:
 - 1. Bobrick B-221, Classic Series surface-mounted toilet seat cover dispenser or approved equal.
- D. Soap Dispenser: Provide soap dispenser at each sink and as shown on the drawings complying with the following:
 - 1. Products: Bobrick B-2013 Automatic Wall-Mounted Foam Soap Dispenser or approved equal.
- E. Grab Bars: Provide stainless-steel grab bar as shown in the drawings and complying with the following:
 - 1. Products: Bobrick B-6806 series in lengths indicated on drawings and as required by ANSI 117.1
 - 2. Stainless-Steel Nominal Thickness: 18 gauge.
 - 3. Mounting: concealed mounting with stainless steel set screws
 - 4. Gripping Surfaces: Smooth, satin finish

- 5. Outside Diameter: 1-1/2 inches (38 mm)
- F. Sanitary Napkin Disposal Unit: Provide stainless-steel sanitary napkin disposal unit complying with the following, at each toilet stall at women's and unisex restrooms.
 - 1. Products: Bobrick B-353 Classic Series, recessed sanitary napkin disposal unit or approved equal. Provide one set of disposal paper liners Bobrick Part No. 270-12 or approved equal.
- G. Mirror Unit: Provide mirror unit above each sink and as shown on the drawings complying with the following:
 - 1. Products: Bobrick B-290 series with concealed hanger or approved equal, provide in sizes as indicated on drawings.
- H. Diaper Changing Table, provide (1) each in rooms 116 and 177
 - 1. Products – Koala Kare – KB200 or approved equal. Color to be granite white or gray, verify with architect.
- I. Utility Shelf with mop/broom holders and rag hooks. Provide one above each mop sink.
 - 1. Products – Bobrick B-239 x 34 or approved equal.
- J. Coat Hooks as shown in the drawings, assume twelve total.
 - 1. Products – Coathook by SWG or approved equal. Finish to be Ash and Steel, verify with Architect.

END OF SECTION 10 28 00

SECTION 104413 - FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET <FEC>

- A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. American Specialties, Inc.
- b. Fire-End & Croker Corporation.
- c. GMR International Equipment Corporation.
- d. Guardian Fire Equipment, Inc.
- e. JL Industries, Inc.; a division of the Activar Construction Products Group.
- f. Kidde Residential and Commercial Division.
- g. Larsens Manufacturing Company.
- h. MOON American.
- i. Nystrom, Inc.
- j. Potter Roemer LLC.
- k. Strike First Corporation of America.

- B. Cabinet Construction: Nonrated.

- C. Cabinet Material: Aluminum sheet.

- D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rounded-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

- E. Cabinet Trim Material: Extruded-aluminum shapes.

- F. Door Material: Aluminum sheet.

- G. Door Style: Center glass panel with frame.

- H. Door Glazing: Tempered float glass (clear).

- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide recessed door pull and friction latch.
2. Provide concealed hinge permitting door to open 180 degrees.

- J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

- K. Materials:

1. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
 - a. Finish: Clear anodic.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. 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 walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Provide inside latch and lock for break-glass panels.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 3. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits emission testing, and Submittal requirements for IEQ credit Low Emitting Materials as specified in Section 01 35 15 – LEED Certification Procedures.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- F. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."
 - 2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with drawings to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace 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 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 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:
 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Wet-Chemical Type: For use at Kitchens. UL-rated Class K, 5 lb nominal capacity, in manufacturer's standard Class K container.
- C. Multipurpose Dry-Chemical Type: For use at all other locations. UL-rated, 5 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 104416

SECTION 11 01 40 FALL RESTRAINT / FALL PROTECTION SYSTEMS

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Design / Build fall restraint systems mounted at roof for access to solar panels

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Engineered calculations, provided and stamped by a structural engineer licensed in the Washington State.
- C. Shop Drawings: Show layouts and types of fall protection components and accessories. Include the following:
 - 1. Anchorage details, including connection to supporting structure for suspended units.
 - 2. Details of juncture of exposed surfaces with adjacent finishes.
 - 3. Accessories.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in the manufacture, design/engineering and install of fall protection systems and maintenance equipment with at least 10 years of successful documented experience and twenty installations similar in size and type proposed for this project.
1. The design design/engineering and installation of the specific fall protection system for the project may be provided by a separate company provided they have been trained and are authorized by the manufacturer to design, engineer and install the manufacturer's fall protection systems; and the separate company does not subcontract any part of the design/engineering and installation to a third party.
 2. Manufacturer shall have specific liability insurance (products and completed operations insurance in the amount of \$2,000,000). This insurance must cover the failure of the safety anchor itself.
- B. Design/Engineering and Installation Company (Designer/Installer): If not the manufacturer, shall be a single, self-contained company specializing in both the design and installation of fall protection systems and maintenance equipment (subcontracting the design and/or installation functions to a separate company is not acceptable and will not be considered.)

1.7 PERFORMANCE

- A. Comply with OSHA and WISHA requirements for fall arrest and fall restraint systems.
1. Design fall arrest anchor system to all free movement of persons over entire roof while attached to full body harness, retractable life line, or vertical life line to catenary lines attached to D-ring or eye at each fall arrest anchor. Include quick release attachments.
 2. Design upright anchors as instructed by manufacturer in layout indicate or otherwise acceptable to architect. Equally space uprights as shown or between 16' and 20' on center so that only one catenary line is needed to connect to D-rings or eyes at each row of uprights.
 3. Design fall arrest system for one person and fall restraint system for up to four persons on roof.
 4. Design fall arrest anchors with permanent attachments to roof sheathing and structure to resist 5000 pounds pull-out force. Include design as necessary to transfer design loads.
 5. Design fall arrest system to limit fall distance to 6' and go limit arrest force to 1800 pounds or less.

1.8 COORDINATION

- A. Coordinate layout and installation of fall restraint / fall arrest systems with adjacent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND INSTALLERS

- A. Source Limitations: Obtain all parts and products of fall restraint and fall arrest system from single manufacturer, including but not limited to Guardian Fall Protection.

B. Installer Qualifications

1. Company specializing in work of the Section with minimum three years documented experience
2. Either same as manufacturer, or certified by manufacturer as qualified to perform work of the Section.
3. Able to document successful installations of manufacturer's fall arrest/fall restraint system

2.2 PRODUCTS.

A. Fall restraint / fall arrest systems and all associated accessories required for complete installation and system.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Guardian Fall Protection (1(800) 672 7892)
 - b. Coordinate length of posts with roof assembly including thickness of assembly and size of waterproof boot around post.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

1. Install fall arrest system in accordance with manufacturer's directions and contract documents. Where these may be in conflict in the more stringent requirements govern.
2. Lay out fall arrest system in accordance with accepted shop drawings.
3. Isolate dissimilar metals to prevent contact.
4. Weld fall arrest anchors directly to structural steel as required by manufacturer and to comply with design requirements and as necessary for watertight, secure, permanent attachment.

B. CLEANING

1. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 110140

SECTION 11 40 00 - FOODSERVICE EQUIPMENT SPECIFICATIONS

PART 1 - GENERAL

Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.1 RELATED DOCUMENTS

- A. General provisions of the contract, including Foodservice Equipment General Conditions, Supplementary Conditions and General Documents, other Division 1 Specification Documents and other Division 1 specification sections apply under this section.

1.2 SCOPE OF WORK

- A. Furnish all labor, materials and services necessary for the procurement and installation of foodservice equipment in strict accordance with the Contract Documents and local codes including that which is reasonably inferred. No extra charge will be allowed for that which the Kitchen equipment contractor should be familiar.
- B. Supervise and provide required instructions for work to be performed by other contractors in connect with requirements for all equipment under this section.
- C. Related Sections include:
 - 1. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 - 2. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
 - 3. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Floor and setting beds, quarry tile and base, masonry pads, walls and finishes, ceilings and related building work: Divisions 03 through 09.
- B. Wall backing to support all wall mounted equipment: Division 6 and 9.
- C. All water, waste, indirect waste piping from sinks, services to the equipment including all shut-off valves, plumbing trim, traps, etc., and final connections to the equipment except as specified herein: Division 22 and 23.
- D. All floor sinks and floor drains: Division 22.
- E. Piping sleeves for refrigeration and drain lines through building floors: Division 22.
- G. All electric services and components including wiring to and final connections to all equipment except as specified herein: Division 26.
- H. Furnishing and installation of conduit at cold storage rooms in cooperation with the Kitchen Equipment Contractor: Division 26.
- I. Furnishing and installation of main power lines to refrigeration systems control panel and wiring for control/defrost heaters between panel and coils in accordance with factory supplied wiring diagrams and local codes: Division 26.

- J. Installation of light fixtures furnished loose at cold storage rooms: Division 26.
- K. Connection of cold storage room temperature alarm system to the building security system: Division 26.
- L. Ground type receptacles for all wall mounted outlet to be used for plug-in equipment: Division 26.

1.4 OWNER/PURVEYOR FURNISHED EQUIPMENT

- A. Obtain and coordinate manufacturer and model number not less than 60 days before equipment is required.
- B. Obtain and coordinate utility requirements.

1.5 EXISTING EQUIPMENT

- A. Items of equipment scheduled and specified "Existing" or "By Owner" shall be removed from their present location and reinstalled as shown on the drawings and hereinafter specified.
- B. Verify location of existing equipment with Owner.
- C. Verify utility and/or special conditions required for re-install.
- D. Existing equipment utility connections shall be disconnected by others.
- E. All equipment shall be thoroughly cleaned and all broken or defective components replaced.

1.6 REGULATIONS

- A. All work and materials shall be in accordance with the latest rules and/or regulations of agencies/authorities having jurisdiction.
- B. All regulations, including building codes, and other codes applying to this jurisdiction should be followed. In addition all equipment shall comply with the following:
 - 1. Local Health Code.
 - 2. National Fire Protection Association, Kitchen Ventilators (NFPA-96).
 - 3. National Electric Manufacturer's Association (N.E.M.A.).
 - 4. Underwriters Laboratories Inc., (U.L.), must bear label. National Electric Code, (N.E.C.).
 - 5. National Sanitation Foundation, (N.S.F.), including NSF-7, must bear label in jurisdictions requiring the same.
 - 6. American Society of Mechanical Engineers must carry the (A.S.M.E.) stamp.
 - 7. American Gas Association, (A.G.A.).
 - 8. Occupational Safety and Health Act (O.S.H.A.) Standards.
 - 9. Hazard Analysis Critical Control Path (H.A.C.C.P.) Standards.
 - 10. American Disability Act (A.D.A.) Standards.
 - 11. Federal Energy Independence and Security Act of 2007 (HR6).
- A. The Contract Documents shall govern wherever they require larger sizes or higher standards than are required by regulations.

- B. The regulations shall govern whenever the Contract Documents require something which will violate the regulations.
- C. When seismic regulations are applicable, all equipment shall be fabricated and installed in accordance with those regulations. All seismic requirements shall be shown on all submittals. Submit requested information to the agencies and authorities having jurisdiction.
- E. No extra charge will be paid for furnishing items required by the regulations, but not specified and/or shown on the drawings.
- F. Rulings and interpretations of the enforcing agencies shall be considered a part of the regulations.

1.7 EQUIPMENT SUBSTITUTIONS

- A. Refer to Division 01 – General Requirements.
- B. Bids are to include price for each item, with a separate subtotal price for buy-out equipment, fabricated equipment, delivery, installation, and performance bond. Bidders may submit, pre-approved substitutions, other brands, and models of equipment. Bids will not be considered if they do not include pricing for all base items, even if substitutions are included. Substitutions shall be quoted on a separate page attached to the primary bid.
- C. When proposing and providing substituted equipment, Kitchen Equipment Contractor shall and pass on to Owner all lawful rebates, refunds, “spiffs”, credits, and discounts afforded it by virtue of its contract with those manufactures providing substituted equipment.
- D. Substitutions for engineered systems such as Exhaust Hoods, Refrigeration Racks and Walk-in Cooler/Freezer Assembly’s may be submitted in accordance with paragraph “B” above. If an alternate manufacture is accepted by the Owner, time spent by consultant, for coordination efforts with design team engineers via meetings or conference calls etc. will be back-charged to KEC at Consultants Standard hourly rates.
- E. Unspecified substitutions must be equal in all respects to the base equipment specified including all standard features. Bids for such substitutions must state the manufacturer, model number and include illustrations, specifications, capacities and operational data with the bid.
- F. If substitutions require different utility/building conditions, electrical, plumbing, ventilation, etc., from those specified, a complete list of those changes for each item shall be included with the substitute bid. The cost of these changes may become the responsibility of the Kitchen Equipment Contractor.
- G. Substitutions shall be submitted for approval prior to bid date. Acceptance or rejection of the substitutions will be at the discretion of the Owner and/or Designer prior to the bid date.
- H. Substitute manufacturer/model numbers listed in itemized equipment specifications can be assumed by bidders to be acceptable substitutions and do not need to be identified in bid.

1.8 REVIEW OF CONTRACT DOCUMENTS

- A. Unless expressly stipulated, and in a timely manner, no additional allowances will be made for Contractors or Manufacturers for errors, omissions or ambiguities not reported at time of bidding.
- B. Carefully review and compare the Contract Documents and at once report to Owner and/or Designer any errors, ambiguities, inconsistencies or omissions. Unless expressly stipulated,

and in a timely manner, Kitchen Equipment Contractor shall be liable to Owner or Designer for any damage resulting from such errors, inconsistencies or omissions in the Contract Documents. Work shall not be done without approved Drawings, Specifications and/or Modifications and without receiving prior written authorization from Owner or Designer.

1.9 WARRANTY

- A. All equipment, fixtures and materials furnished and installed shall be guaranteed against defect in workmanship and material. All repairs and replacements which may have become apparent and necessary by reasons of such defects, during the first year after final completion and acceptance of equipment installation, shall be made without cost and expense to the Owner. All such repairs and replacements shall be made at a time and during hours satisfactory to the Owner.
- B. For all commercially manufactured equipment that has refrigeration systems and semi-hermetic compressors, furnish an additional four (4) year warranty on all compressors.
- C. Warranty period shall commence with the date of final acceptance of installation by Owner.
- D. Components of equipment subject to replacement prior to one(1) year's use and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator are not intended to be included within the scope of warranty.
- E. Provide all labor, material, refrigerants, and incidental expenses to maintain the temperatures specified on all refrigeration systems. Systems to be kept in first class working condition for a period of one (1) year from date of acceptance by Owner, or the date systems are put into operation, whichever occurs first, without additional cost to the Owner.

1.10 SUBMITTALS

- A. Use of Consultant's Drawings
 - 1. Consultant drawings are not intended for construction purposes, but are information intended only for use by the Architect and Engineers as an aid in the design of the building and utility distribution systems and for bidding equipment purchase. Consultant drawings in electronic format will not be issued by the Architect or Owner to third parties, including equipment suppliers, without express written consent of the Consultant.
 - 2. Consultant base Equipment Plans and Equipment Elevation Sheets will be provided to contracted equipment supplier in electronic format on request without charge. Utility rough-in/connection schedules and plans will be provided in electronic format on payment by the KEC to Consultant of a nominal fee of \$250 per drawing sheet for third party formatting. Regardless of fees charged the transfer of drawings is not to be considered a sale and the Consultant makes no warranties, express or implied, of Merchantability or of fitness for a particular purpose.
 - 3. Regardless of drawing formats provided it will remain the responsibility of equipment supplier to develop submittals in accordance with the Foodservice Equipment Specific Conditions and assume all required responsibilities thereto. Time spent in checking KEC re-submittals, for KEC deficient initial submissions, will be back-charged to the KEC at consultants standard billing rates. Time spent in extraordinary coordination efforts by the Consultant necessitated by poor performance of the KEC will be back-charged to the KEC at consultants standard billing rates. The Consultant is not to be liable for errors or omissions by the KEC's use of electronic data provided by the Consultant or the development of data used in the submittal approval process.
- B. Product Data

1. After award of contract and before proceeding with the purchase of manufactured equipment, submit a bound Electronic PDF file copy of specification sheets consisting of:
 - a. Hard Cover.
 - b. Title Sheet.
 - c. Index all items with columns for: Item number, quantity, description and status (fabricated, manufactured, by Owner/Operator, by General Contractor, et.).
 - d. A typewritten lead sheet for each manufactured equipment item showing: Item number, quantity, description; manufacturer's name, address and telephone; model number; optional finishes, equipment, accessories and modifications; utilities required and special notes.
 - e. Manufacturer's specification sheets and/or drawings.
2. Submittals not in the above format will be returned for re-submittal.

C. Drawing Submittals

1. For all drawing submittals provide a bound Electronic PDF file copy.
2. Plan drawings shall be at a scale of $\frac{1}{4}" - 1'-0"$ (1:50).

D. Rough-In Drawings

1. Drawings shall be dimensioned, showing ventilation requirements, floor and wall sleeves, plumbing, gas, steam, and electrical connections, including those items supplied by the Owner. Provide concrete pad dimensions, depressions and special conditions as required for equipment.
2. The following shall each be drawn on separate sheets and/or plans: Itemized Equipment Plan/Schedule; Plumbing; Electrical; Building Works and Ventilation; Refrigeration and Beverage Systems.
3. Utilities shall be stubbed out of walls wherever possible.
4. Verify mechanical, electrical, and ventilation rough-in and sleeve/conduit locations before floor slabs are poured.
5. In the event rough-in has been accomplished before the award of the contract, check existing facility and furnish all equipment to suit building conditions and utilities. No extra charges shall be allowed for utility changes to fit equipment during installation and connection.

E. Wall Backing Drawings

1. Prepare and submit wall backing drawings. The drawings shall show the location and size of all wall backing required. The drawings shall be submitted for checking and to the General Contractor in time for the wall backing to be installed prior to closing of the walls.

F. Shop Drawings

1. Prepare and submit shop drawings for all special fabricated items of work included in this contract. The detail drawings shall be submitted at minimum of $\frac{3}{4}"$ (1:20) scale for elevations and $1-1/2"$ (1:10) scale for sections. Drawings shall show all dimensions, all details of construction, installation and relation to adjoining and related work. Drawings shall show all reinforcements, anchorage and other related work required for the complete installation of all fixtures.

G. Refrigeration Drawings

1. Manufacturer's drawings and manufacturer's specification sheets shall be submitted for approval prior to commencing work. Drawings shall include refrigeration piping showing actual line sizes and system allocation, evaporators, compressors, condensers, and required valves and accessories.

2. Specification sheets and drawings shall be presented in bound sets with all items and piping properly identified, including model, system allocation, any required electrical characteristics and BTU (KCAL) load as applicable.

H. Record Drawings

1. At the conclusion of the project and prior to final payment, provide updated record Drawings incorporating all changes that occurred during construction in the form of CAD disks and one (1) hard copy set.
 - a. Submittal drawings shall include as applicable; mep rough-ins, custom fabrication, engineered systems including exhaust hood, refrigeration, etc.

I. Checking

1. Checking product data, rough-in drawings, wall backing drawings, shop drawings, and refrigeration drawings by Designer is for design concept only, and does not relieve the Kitchen Equipment Contractor of responsibility for compliance with Contract Documents, verification of utilities with equipment requirements for conformity and location, verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.
2. Drawings shall be prepared on the Kitchen Equipment Contractor's sheets and by his employees. Drawings and any part thereof created by photograph, paste-up, or other methods using Designer's drawings and/or details will be returned for re-submittal.
3. Submittals and checking shall be accomplished before ordering equipment or starting fabrication.

J. Requests for Information (RFI's)

1. All RFI's to be submitted per General Conditions or otherwise by e-mail to info@clevengerassoc.com or if known, by e-mail directly to the project manager.

K. Mailing and Distribution

1. All drawings shall be delivered via E-mail, FTP site or General Contractor share site.
2. After checking, supply the specified number of distribution prints and as many as ten (10) corrected product data books as directed by the Architect, General Contractor or Owner.

1.11 PARTS AND SERVICE MANUALS

A. Furnish two (2) bound sets of parts and service manuals.

1. The manuals shall include a source directory for parts and service for all items.
2. The manuals shall be submitted in time to allow review and transmittal to the Owner/Operator prior to start-up and demonstration of the equipment. Manuals must be submitted before the Owner will issue final acceptance of the installation.
 - a. Provide a bound electronic pdf file copy on cd of the record drawings as part of this submittal.

1.12 VERIFICATION AND COORDINATION OF PROJECT/DATA

A. Range Lines

1. All front manifold range lines shall be assembled and aligned at the factory before shipment, including back guards, high shelves and salamanders.

B. Pans and Inserts

1. Verify sizes with Owner on the following items before ordering or fabrication:
 - a. Steam Pans.
 - b. Sheet Pans.
 - c. Trays.
 - d. Glass and Cup Racks.

C. Quietness of Operation

Quietness of operation of all food service and refrigeration equipment is a requirement. Remove or repair any equipment producing abnormal and objectionable noises.

D. Delivery and Entry

Verify all conditions at the building, particularly door openings and passageways for large equipment. Coordinate with the General Contractor access to insure delivery of equipment to the required areas. Coordination shall include, but not limited to, early delivery, hoisting, window removal and/or delay of wall construction. All special equipment, handling charges, window removal, etc. shall be paid for by the Kitchen Equipment Contractor.

E. Connection Terminals

All equipment will be complete with standard connections as they relate to their Country of Origin. It shall be the responsibility of the Kitchen Equipment Contractor to provide any and all required adaptors to assure the proper connection to the conditions at the job site.

F. Site Verification

Notify Designer, Owner and the General Contractor in writing if, in the Kitchen Equipment Contractor's opinion, the jobsite is not adequate to insure proper installation of the equipment. Notification shall be in writing with sufficient time to effect corrective measures to meet the installation schedule.

G. Cold Storage Rooms and Refrigeration Systems

1. Coordinate the timely installation of the wearing floors inside the cold storage rooms with the General Contractor to prevent prolonged exposure of the floor insulation.
2. Prohibit cold storage rooms from being used by any other trade for storage or work areas. Repair or cause replacement to any damaged areas on the interior of the cold storage rooms, if the damage was caused due to the cold storage rooms being used for storage or work areas.
3. Advise acceptability of the remote refrigeration condensing unit's location in regard to ambient temperature, noise and accessibility. If the proposed location is unacceptable for any reason, advise Owner and request direction in writing.

1.13 LEED SUBMITTALS

A. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures

1. LEED Submittal Coversheet.
2. Materials and Resources Submittals:
 - a. MR Credit BPDO – Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these location to project site for products extracted and manufactured within 100 miles of the project site.

PART 2 - PRODUCTS

2.1 COMMERCIALLY MANUFACTURED EQUIPMENT

- A. All items of standard equipment shall be the latest model at time of delivery.
- B. Follow manufacturer's directions used to fulfill this contract which cover points not necessarily shown on the drawings or specifications.
- C. All doors shall be hinged as shown on plans.

2.2 PLUMBING WORK

- A. Provide suitable pipe slots, chases and/or do all drilling, punching and cutting of equipment required to provide access for Division 22 connections and/or runs. Such work performed at the job site shall be of the same quality as similar work in the shop.
- B. To insure proper clearance for cleaning, all horizontal piping lines shall be run at the highest possible elevation through equipment and not less than 6" (150 mm) above floor, wherever possible.
- C. Indirect waste piping shall be installed in accordance with the local codes. Piping shall run as described hereinafter, and shall discharge into floor sinks. Extend piping to a point of at least 2" (50 mm) above rim of floor sink and cut bottom on 45o angle. All indirect waste piping shall be installed and routed in a manner to insure proper drainage and shall conform with shelves, spaces, equipment or building conditions. Indirect waste piping to be secured to fixture.
 1. Indirect waste piping form ice bins, ice pans or similar items shall be insulated to prevent condensation.
- D. Water inlets shall be located above the positive water level to prevent siphoning of liquids into the water system. Wherever conditions shall require a submerged inlet. Provide a suitable type of check valve and vacuum breaker.
- E. Where exposed, piping and fittings shall be chrome plated.
- F. All faucets intended to dispense water for human consumption shall be manufactured from pure stainless steel that contains zero lead, no brass allowed in the waterways of the product. Finish shall be polished stainless steel

Type 1: Faucet: 8" c/c wall mount base with ½" NPT male threaded inlets, lever handles & 12" swing nozzle with B-PT stream regulator outlet, ceramic cartridges with check valves & 24" stainless steel flexible supply hoses.

T&S Model # B-0231-CR-KIT

Type 2: Faucet: 8" c/c wall mount with ¾" NPT female inlet elbows & big-flo 14" swing nozzle.

T&S Model # B-0290-14

Type 3: Faucet: Single hole deck mount mixing, 6" swing nozzle with B-PT stream

- regulator, lever handles, eterna cartridges with spring checks & 18" flexible stainless steel supply hoses.
T&S Model # B-0202
- Type 4: Faucet: Pot & Kettle sink mixing with 14" swing nozzle, 4-arm kitchen handles & 3/4" NPT inlets.
T&S Model # B-0293-14
- Type 5: Faucet: Single hole deck mount, 5 3/4" swivel/rigid gooseneck with B-PT stream regulator outlet, eterna cartridges with spring checks & 18" flexible stainless steel supply hoses.
T&S Model # B-0300
- Type 6: Faucet: Single pantry, ceramic cartridges with check valve, 6" swing nozzle with B-PT stream regulator outlet, lever handle, 1/2" NPSM male inlet & tailpiece.
T&S Model # B-0207-CR
- Type 7: Pre-Rinse Unit: Easy install, 8" c/c wall mount base, elbows with 1/2" NPT male inlets, 18" riser, B-0970-FEZ vacuum breaker, 44" flexible hose, 0.65 GPM low flow spray valve, ceramic cartridges with check valves & 6" wall bracket.
T&S Model # B-2278-CR-C-EL
- Type 8: Pot filler: Wall mount, single control, double joint swivel nozzle, on-off volume control outlet with insulated grip, 4-arm handle & 1/2" NPT female inlet.
T&S Model # B-0592
- Type 9: Dipperwell Faucet: With spout, stainless steel bowl & removable inner overflow cup.
T&S Model # B-2282-01
- Type 10: Water Station: With pedestal type glass filler, adjustable flow outlet, 18 gauge stainless steel drip pan with drop-in grid & 1-1/4" drain.
T&S Model # B-1230-12
- Type 11: Pre-Rinse Unit: Easy install, 8" c/c wall mount base, add-on faucet with ceramic cartridge and lever handle, 12" swing spout with B-PT stream regulator outlet, 18" riser, B-0970-FEZ vacuum breaker, 44" flex hose, 0.65 GPM low flow spray valve, ceramic cartridges with check valves & 6" wall bracket.
T&S Model # B-2278-A12CRCEL
- Type 12: Pre-Rinse Unit: Easy install, single deck mount base, B-0970-FEZ vacuum breaker, ceramic cartridges with check valves, 18" flexible supply hoses, 24" riser, 44" flex hose, spray valve with 2.2 GPM non-splash aerator, lever handles & 6" wall bracket.
LEED Comment:
WE Indoor Water Use Reduction Prerequisite.
Pre-Rinse Spray valves must be <1.3 gpm
T&S Model # B0113-CR-BVB-A

G. DRAINS AND WASTES

1. Furnish all necessary drains and wastes with the equipment and as follows:

- Type 1: Drain: Rotary waste valve with twist handle, 3-1/2" sink opening, 2" NPT male outlet & 1-1/2" NPT male adapter.
T&S Model # B-3950
- Type 2: Drain: Rotary waste valve with twist handle, 3-1/2" sink opening, 2" NPT male outlet & 1-1/2" NPT male adapter & removable strainer basket.
T&S Model # B-3950-SB
- Type 3: Drain: Rotary waste valve with twist handle, 3-1/2" sink opening, 2" NPT male outlet & 1-1/2" NPT male adapter & overflow tube with head assembly.
T&S Model # B-3950-01
- Type 4: Drain: Rotary waste valve with twist handle, 3-1/2" sink opening, 2" NPT male outlet & 1-1/2" NPT male adapter & overflow tube with head assembly & removable strainer basket.

T&S Model # B-3950-01-SB

H. Quick Disconnect Valves

1. Gas Lines
 - a. Flexible gas connectors shall be manufactured by Dormont Manufacturing Co., kits to include the following: Gas Connector, Type 304 stainless steel hose, stainless steel braid with 360 degree rotational end fitting and a flexible polymer coating with an anti-microbial agent. Safety Quik quick disconnect valve with thermal shutoff and one-hand operation. SwivelMax (2) multi-plane swivel fitting. Coiled restraining cable and hardware to prevent strain on gas connector. Safety-Set wheel placement system provided with anchoring system including removable thumb screws. Moveable gas appliance connectors must be of sufficient length to attached properly to the device and include all necessary fittings and related appurtenances required for the proper operation of the assembly. Assembly to be CSA design certified to ANSI Z21.69/CSA 6.16 standards and be NSF certified, limited lifetime warranty.
2. Water Lines
 - a. Flexible water hoses with quick disconnect for ice machines, coffee and tea brewers and any mobile equipment requiring water connections. Swirl™ Water Supply Line shall be manufactured by Dormont Manufacturing Co. and be a coiled retractable polyurethane hose that is NSF certified with a maximum allowable temp of 160 degrees and maximum allowable pressure 100 PSIG. Lead Free Brass Quick Disconnect fitting to be provided with 2-way shut off to stop water at supply side and prevent back flow from equipment when disconnected. Flexible water line must be of sufficient length to attach properly to the device and include all necessary fittings and related appurtenances required for the proper operation of the assembly.
3. Combi Oven Water Connectors
 - a. Flexible Combi-Oven water connectors shall be manufactured by Dormont Manufacturing Co. and should include the following: Combi-Oven Water Connector, Type 304 stainless steel hose, 304 stainless steel braid with Lead Free Brass flared end fittings, Lead Free Stainless Steel 2-way quick disconnect to be provided with 2-way shut off to stop water at supply side and prevent back flow from equipment when disconnected, Lead Free brass garden hose adapter, coated in gray anti-microbial PVC, limited lifetime warranty.
4. Water Filters
 - a. All ice machines, combi-ovens, coffee and tea makers or urns, carbonated beverage dispensers and steam equipment shall have a water filter of proper type as manufactured by OptiPure, or as required by the equipment manufacturer.

2.3 FILTER EXHAUST HOODS, AND/OR WATER WASH VENTILATORS, AND UTILITY DISTRIBUTION SYSTEMS

- A. Provide all labor, material and installation services; verify sizes and locations of duct connections; and provide all exposed duct work from hoods, ventilators, and dishwashers to building duct work, including trim, closure panels and watertight or grease tight connection.
- B. 18-gauge (1.3 mm) type 304 stainless-steel external welded construction, in accordance with the latest edition of N.F.P.A. No.96 and International Mechanical Code, including all applicable appendices. Exposed welds to be ground and polished. Exhaust hoods to be U.L. Listed as available for length specified.
- C. Light fixtures to be U.L. listed for cooking equipment exhaust hoods, NSF-approved, and with sealed safety lenses.

- D. Furnish welded stainless-steel formed duct collars at ceiling or wall duct connections. Verify size and location of duct connections required in this contract before fabrication.
- E. Factory pre piped liquid chemical or water fire suppressant system complying with applicable local and N.F.P.A. regulations. Wet chemical fire suppression systems to comply with UL 300 Standards. Each pull station is to be clearly identified with a permanent type label, as to which exhaust hood(s) it is for. Each exhaust hood is to have a matching permanent type label, identifying which pull station activates its fire system. All pull stations shall be recessed in wall where possible.
- F. Water wash control panel to be by the same manufacturer as the ventilator/hood, with time clock control for automatic operation. Provide stainless-steel trim strips for recessed control cabinet applications. Where applicable provide stainless-steel chase for surface mounted control panel, from top of panel to ceiling, full width, and depth of panel.
- G. Abbreviations:
 - 1. ASTM: American Society for Testing and Materials
 - 2. CE: European Union Safety Standards
 - 3. CSA: Canadian Standards Association
 - 4. DCV: Demand Control Ventilation
 - 5. ETL: Intertek
 - 6. FPM: Feet Per Minute
 - 7. GFCI: Ground Fault Circuit Interrupter
 - 8. IMC: International Mechanical Code
 - 9. LED: Light Emitting Diode
 - 10. MUA: Make-up Air
 - 11. NFPA-96: National Fire Protection Association
 - 12. NSF: National Sanitation Foundation
 - 13. UDS: Utility Distribution System
 - 14. UL: Underwriter Laboratories
 - 15. VAV: Variable Air Volume
 - 16. VFD: Variable Frequency Drive
 - 17. WG: Water Gauge (in inches)
- H. Water Wash Exhaust Hood w/Make-Up Air
 - 1. Furnish and install a complete commercial kitchen exhaust ventilator/canopy/hood designed for efficiency, durability, operational convenience, and productivity. The canopy shall bear the Underwriters Laboratories U.L. label or ETL label, UL-listed range hood without exhaust fire damper per standard 710 and be fabricated in compliance with current NFPA-96 and a sanitation mark from an approved agency. The exhaust airflow shall be within the ETL or UL-listed air volumes and be based upon ASTM Standards F1704-05 and F2474-05 at minimum and must meet or exceed Washington State Energy Code requirements. Exhaust canopy and make-up air plenum shall be sized in length, width, and height to achieve successful capture/containment, and exhaust-to-atmosphere according to ASTM 1704-09 in relation to cooking equipment served below canopy. Grease extraction shall be provided by a single or multiple stage assembly that is tested to ASTM 2519-2005 to at least 93% efficiency and allows no more than 9 microns of grease particulates in size to enter the exhaust plenum, riser and ductwork beyond. Controls shall be listed by UL 508A or ETL and any control enclosure shall be NEMA 1 rated and be listed for installation inside the exhaust hood utility cabinet.
 - 2. Operational exhaust airflow engineering shall be based on the convective heat generated by the appliances/equipment underneath each canopy. Exhaust hood engineering shall include convective heat calculations based on the input power of the appliance/equipment served as defined by ASTM Standards F-1704-05 Capture & Containment and F-2474-05 Heat Gain to Space. Final air volume calculations shall

comply with the hood listing. Engineering shall not include any extraneous mitigating, exposed, and materially added capture/containment helps such as end skirts or end panels. Engineering shall assume a minimum 80% air volume MUA (Make-Up-Air) from a tempered source via a low velocity air flow perforated plenum with its bottom set at the top of the canopy. Plenum shall require no lights within perforated panels. Overall exhaust design shall limit FPM flow of MUA -including air from general air handling units- to a maximum of 75 FPM at bottom front lip of exhaust hood. Exhaust volume and static pressure engineering shall take grease extraction method, current duct and fan planning into account and assume operation at sea level at 75 F. ambient temperature in foodservice zones serviced.

3. Exhaust canopy and MUA plenum design and installation shall be in accordance with the manufacturer's recommendations and conform to NFPA-96 guidelines and all applicable local codes. Canopy design shall take NFPA-96 and IMC code-required clearance to combustible requirements into account and clearly state exceptions and tolerances for distances within engineering and final submittal documents. Clearance engineering shall address construction make-up near or adjacent to canopy. Construction details to be provided by Architect of Record in final design process. Continuous front and rear angled mounting brackets - welded to canopy - shall be provided to facilitate mounting to wall and hanging from overhead building structure as applicable. Provide canopy with all-welded duct collar(s), and all hangers, supports and miscellaneous accessories as required for installation. Canopy construction shall be compliant with NFPA-96 standards.
4. The entire canopy shall be constructed of 18-gauge (or thicker) stainless-steel with a #4 finish. Each canopy shall have a grease extraction filter housing of the same material as the canopy liner. The grease extraction filter housing shall be equipped with a concealed drip gutter the full length of the canopy that discharges into a minimum .5-gallon grease container for easy removal and daily cleaning. Canopies manufactured in multiple sections shall be provided with bolts, clips and all necessary hardware for reconnecting by the canopy installer. Control and lighting wiring and drains are to be disconnected for shipment. Reconnection in field shall be by applicable trades. A built-in wiring chase shall be provided for any applicable electrical controls on the hood face or elsewhere and shall not penetrate the capture area or require an external chase way.
5. Hood manufacturer to provide water wash system for automatic hood plenum cleaning and grease extractor cleaning. The hood shall include as-required full-length wash manifolds equipped with brass spray nozzles and stainless-steel threaded plumbing fitting extending from low end of gutter for final plumbing connection by trades. When the wash cycle is initiated, the exhaust fan shall modulate or shut-off according to applicable code and manufacturer's wash system. The wash sprays shall come on for the length of time programmed in the control panel. All controls and components for operation of the Water Wash system shall be housed in the Exhaust Hood Control Cabinet. It is assumed that grease extractors will also require additional as-needed heavy cleaning via removal and wash separate from canopy assembly.
6. The canopy shall be equipped with recessed LED light fixture(s) complete with bulbs with color temperature at maximum 3000K with the following certifications U.L., CSA, NSF and CE for use in grease exhaust hoods in quantity sufficient to provide 50-foot candles at the cooking/working surface when hood is mounted 80" A.F.F. LED Light fixture(s) shall be factory pre-wired to a single connection point. Lamp body shall be stainless steel frame with a high temperature silicone seal. Junction box to accept standard 1/2" NPT fitting. Fixture shall contain no mercury or lead. Includes Light Switch mounted on hood face in recessed and fully enclosed manner unless otherwise controlled by hood control cabinet within working zone. Provide wires and ground for controls and light in flexible conduit 6' beyond end of canopy. Canopies built in multiple sections shall be furnished with coiled flex conduit for interconnecting sections.
7. The canopy shall include an "Auto-start" controller and temperature sensor designed and installed to automatically activate the exhaust fan whenever cooking operation occurs. The activation of the exhaust fan shall occur through, and interlock with, the cooking appliances by means of heat sensor, per IMC 507 standards and requirements.

8. Exhaust canopy operational planning shall include shut-down requirements for a fire condition based on applicable national, state, and local fire codes.
 9. Exhaust hood shall be provided with an integral DCV (Demand Control Ventilation) system capacity.
 10. Provide hood pre-piped in factory for Fire Suppression System with concealed piping and drops in roof of canopy at required locations above equipment served below.
 11. Provide with stainless steel compartment at end of hood for housing Fire Suppression System complete with removable door where shown on drawings.
 12. If not installed against the finished ceiling, provide matching stainless-steel closure panels above hood to finished ceiling, to conceal duct(s) and hood fire suppression system piping; verify height. If finished ceiling is more than 24" above the top of the hood(s), or ceiling is open type ceiling then verify requirement for closure panels with Architect/Interior Designer. Provide maintenance access above canopy where enclosure panels are required.
 13. Access for maintenance and service shall be done without access panels through the roof of the ventilator or at the duct shaft enclosure at the exhaust duct collar.
 14. Grease extraction filters shall be easily removable for cleaning, from the floor area immediately in front of the equipment by utilizing an extractor removal tool as provided.
 15. A factory-certified representative from the exhaust hood manufacturer shall conduct an exhaust hood performance test for each exhaust hood in the Contractor's scope of work at the conclusion of the project when all hoods and related cooking equipment are in full operational mode. Contractor shall have manufacturer's factory authorized representative test and measure exhaust airflow rates, dampers, switches, demand control ventilation, and sequence of operation, with all appliances at operating temperatures. Contractor shall furnish a written report within ten (10) working days of substantial completion and acceptance of the project by the Owner, indicating the design requirements for each hood and the actual operating parameters as tested and measured.
 16. Project-specific shop drawings/submittals shall be prepared and submitted for review and approval by the prospective manufacturer. The hood manufacturer shall supply complete computer-generated submittal drawings. These drawings shall show all-welded exhaust duct collar height and flange dimensions. Duct sizes, CFM and static pressure requirements shall also be clearly defined on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the canopy. Drawings shall include hood sections view(s), hood elevation view(s), and hood plan view(s) complete with specified equipment blocks/families within drawings with equipment item numbers clearly defined and coordinated. No generic block forms/facsimiles of equipment are allowed. Drawings shall include all applicable listings and approvals as well as any applicable wiring or plumbing information. These drawings must be available to the engineer, architect, and owner for their use in construction, operation, and maintenance.
- I. Condensate Exhaust Hood
1. Furnish and install a complete Type II vapor exhaust canopy. The hood shall bear the NSF seal of approval. The canopy shall meet all requirements of the IMC and constructed in strict compliance with NSF standard number 2.
 2. The installation shall be in accordance with the manufacturer's recommendations and all applicable local codes. Size shall be 12" in length and width beyond the furthest edge of equipment below in plan and be 30" in height. Include hangers, supports and miscellaneous accessories as required for installation.
 3. The canopy exposed areas and inner liner shall be 18-gauge 304 stainless steel with a #4 finish. External welded construction in accordance with the latest edition of NFPA 96. All welds to be ground and polished. All exposed external seams shall be ground and polished to match original material finish. Canopy shall have a condensate baffle and be equipped with a full perimeter condensate gutter with a 3/8" threaded drain connection.

4. Where not installed against a finished ceiling provide matching stainless-steel closure panels above hood to finished ceiling to conceal ducting and provide a cleanable washable surface to ceiling juncture.
 5. The canopy shall be equipped with recessed LED light fixture complete with bulbs with the following certifications U.L., CSA, NSF and CE for use in grease exhaust hoods in quantity sufficient to provide 40-foot candles at the working surface when hood is mounted 80" A.F.F. LED Light fixture(s) shall be factory pre-wired to a single connection point. Lamp body shall be stainless steel frame with a high temperature silicone seal. Junction box to accept standard 1/2" NPT fitting. Fixture shall contain no mercury or lead. Includes Light Switch mounted on hood face in recessed and fully enclosed manner. Fan On/Off to be wired to ware washer served below contact for ventilation in tandem with use of machine. Provide wires and ground for light in flexible conduit 6' beyond end of canopy. Canopies built in multiple sections shall be furnished with coiled flex conduit for interconnecting sections.
 6. All-welded duct collar attached to Mechanical Division-provided non-corrosive ductwork pitched to the dish machined. Unit to be exhausted to the atmosphere.
 7. Final welded connections to hood duct collars by the Mechanical Division.
 8. Project-specific shop drawings/submittals shall be prepared and submitted for review and approval by the prospective manufacturer. The hood manufacturer shall supply complete computer-generated submittal drawings including hood sections view(s), hood elevation view(s), and hood plan view(s) complete with specified equipment blocks/families within drawings. No generic block forms/facsimiles of equipment are allowed. These drawings must be available to the engineer, architect, and owner for their use in construction, operation, and maintenance.
- J. Water Wash/Exhaust Control Panel
1. Provide master water wash control panel for canopy water wash system. Panel to be source of digital programming of wash cycles and be locus of incoming and canopy service hot water connections as well as overflow drain. Control panel to also indicate any current faults for water wash system that needs operator attention. Panel number to be applicable to maximum number of hoods allowed to be serviced by one panel.
 2. Field start-up to be performed by manufacturer-authorized service agency.
 3. The master water wash control panel shall be able to provide automatic operation of the exhaust and supply fans in addition to the run & wash cycles of the exhaust hoods in a pre-programmed manner.
 4. The panel shall be complete with a separate electrical and plumbing compartment. Panel shall be designed to allow for 40psi minimum to 80psi maximum water pressure at inlet with water temperature tolerance of 140 F. to 180 F. maximum.
 5. The panel shall be provided with Run/Wash selector switch, wash timer, wash time delay, and a microprocessor for system running and alarm conditions. A terminal strip shall be provided for field wiring.
 6. The panel shall be supplied with a backflow prevention device and downstream backflow prevention devices as directed by code, a detergent pump and low-level alarm. Panel shall be provided with one (1) case four (4) bottles of detergent as well as a single floor-mounted barrel for each panel for supplemental or main detergent supply as needed.
 7. The panel shall be constructed from 14-gauge stainless-steel with hinged lift off doors, have a front locking screw and be recess mounted with a 1.5" wide stainless-steel trim ring. Panel shall be planned to be recessed in wall wherever possible in plan.
 8. The entire panel shall be completely factory preassembled, prewired, and tested ready for final in-field mechanical and electrical connections. Controls shall be listed by UL 508A or ETL and any control enclosure shall be NEMA 1 rated and be listed for installation inside the exhaust hood utility cabinet.
 9. Panel may be combined within or directly adjacent to or conjoined with the Demand Control Ventilation System Panel depending upon manufacturer's system proposed.
 10. Project-specific shop drawings/submittals shall be prepared and submitted for review and approval by the prospective manufacturer. Shop drawings shall include schematic plan

for piping lines, valves, etc. and any control wiring with assignment of responsibility and construction sequence.

11. Start-up and training shall be included in system installation scope.

K. Demand Control Ventilation System and Panel

1. The DCV system shall be provided to allow ventilation upstream from the canopy to be ramped up and down based on received input. The DCV shall be designed to allow for the spectrum of high-capacity cooking down to idle capacity defined by exhaust volume sufficient to capture convective heat from equipment below a commercial cooking exhaust hood canopy. If the minimum idle capacity defined by the exhaust hood manufacturer is greater than 50% of the design exhaust airflow, deviance approval is required from the design team and energy modeler.
2. The DCV system shall be mechanically and electrically designed to interface with the planned upstream multiple hood/ single or multiple (up to four [4] fans per controller) fan system utilized to exhaust to the atmosphere. This interface shall utilize listed programmable resistance temperature detectors mounted inside the exhaust canopy to accurately read sensible heat from the cooking equipment and vary the speed of the exhaust and make-up air fans accordingly. The DCV system must be capable of controlling multiple exhaust fans (4 max.), and MUA fan (Make-Up Air) or AHU (Air Handling Unit) via one system using a sensor alert approach in a programmable fashion.
3. The DCV system shall contain a digital interface panel with connections to Mechanical Division provided VFD (Variable Frequency Drive) system controlling the rotational speed of an AC electric motor driving a ventilator fan system designed to exhaust to the atmosphere as part of their exhaust fan package. The DCV interface/display shall provide controls for canopy lights, programmable schedule, override function, show equipment status, energy savings values, troubleshooting, and control options. Interface shall incorporate room ambient temperature sensor, fire suppression integration controls, VFD connection terminals and be capable of wireless/direct-connect data connections. Panel shall be constructed of 304 series stainless-steel with #4 finish complying with NSF/ANSI 2-2010. Cabling for controls shall be provided in flex conduit extending 6' beyond panel.
4. Each foodservice zone's air systems are targeted be designed to maintain 0.02" WG (water gauge) relative to adjacent spaces. Manufacturer to coordinate engineering to reach this goal where possible.
5. Master control panel shall utilize BACnet communication protocol for building automation and control network compatibility (extend and type of controls to be verified). All to be ASHRAE, ANSI and ISO standard protocol.
6. Upon hood activation, the controller(s) shall turn on the DCV system to its minimum exhaust rate with signal to modulate the exhaust rate between the minimum and maximum set points.
7. DCV shall be designed to allow for programmable temperature adjustments for each individual sensor. DCV shall send a 0-10V modulation signal to each assigned VFD.
8. Multiple programmable algorithms shall be provided per exhaust canopy.
9. Mechanical Division to provide VFDs (Variable Frequency Drive) as part of fan package. VFDs shall allow full adjustment of minimum and maximum frequency set-point for proper kitchen balance. Drives shall contain motor thermal overload protection. Acceleration and deceleration times shall be fully adjustable.
10. Override button shall be provided on each kitchen exhaust hood that ramps the exhaust to 100% of the design exhaust airflow. Override shall have adjustable timeout value integrated into system.
11. Shall be minimum UL 508A listed, and IMC 507.2.1.1 compliant. Only listed and compliant demand control ventilation systems shall be accepted. System shall comply with all local codes.
12. Manufacturer shall perform the complete startup and commissioning process of the DCV system once all installation of the equipment and wiring is certified complete. Startup shall include:

- a. Set all hood sections to design air flow.
 - b. Adjust the VFD set points.
 - c. Verify complete DCV system functionality per Sequence of Operations and maximize system optimization and provide a written report of the functionality of the system.
 13. Division 16 shall be responsible for control wiring between the supplied demand control system control panel and the hood mounted sensors. Division 16 will also be responsible for wiring between the demand control system control panel and the VFDs and then from the VFDs to the exhaust/supply fan motors. Manufacturer to provide inter-connectivity cables between the hoods and associated control panels. Manufacturer shall provide room a temperature sensor. Electrical Division or assigned shall run low voltage and standard voltage wiring cables and required control power.
 14. DCV system operational planning shall include shut-down requirements for a fire condition based on applicable national, state, and local fire codes.
 15. Full system component - as well as electrical, low voltage schematic wiring shop drawings - shall be provided for the DCV system showing scope of sequence, scope of material, product, and installation process.
 16. Start-up and training shall be included in system installation scope.
- L. Utility Distribution System (UDS)
1. UDS is an integral commercial foodservice equipment outlet center system. System shall be completely pre-wired and pre-piped to a single connection point for electrical, cold water and hot water, as required by the equipment specified. Electrical service will not require a minimum over-capacity for future changes in equipment. The UDS shall be UL listed under the category "Commercial Appliance Outlet Center" and manufactured in accordance with the National Electric Code (NEC), National Fire Protection Association (NFPA 96), Uniform Plumbing Code (UPC), National Sanitation Foundation (NSF), and using only UL certified components. Certification by ETL complying with UL-891 standards and CSA C22.2, No. 31-M089 is allowed. The UDS shall be completely pre-wired and pre-plumbed to one final connection point for the following services:
 - a. Electrical: 3-phase; 4-wire w/ground service to main disconnect with shunt-trip breaker in UDS. Power supply must be wye style.
 - b. 20 amps. 120/60/1 phase; 3-wire from ventilator lights to terminal block in UDS.
 - c. 120/60/1 phase from terminal block in UDS to fire suppression system micro switch.
 - d. Cold water
 - e. Hot water
 2. The UDS shall be constructed entirely of stainless-steel type 304 series, #4 finish, not less than 16 gauge. This includes the vertical risers, peaked top, end caps, horizontal raceway, hinged and removable panels. Unexposed items such as the main electrical chase, and the inside raceway section shall also be fabricated from 16-gauge stainless steel. The insulating and supporting materials for the plumbing and electrical components are the only exception to this. The main electrical panel, electrical raceway, and all electrical distribution components shall be isolated from the plumbing chamber and plumbing raceway in accordance with national electric codes. Individual electrical compartments for electrical components in the main electrical riser for separation from the plumbing section will not be accepted. All hardware for utility interconnects for multiple section raceways and risers to be provided by the manufacturer for field re-assembly.
 3. Customized stainless-steel chase ways are required for drain/waste/vent piping from below slab through plane of ceiling/exhaust canopies. Chase ways are shown on issued plans for co-ordination. Each chase way must be field coordinated prior to fabrication and must contain removable inset access panels for installation and any maintenance. Chase ways must allow for the full capacity of the UDS in terms of bulk feed and downstream assigned foodservice equipment connections.

4. The UDS shall have a peaked cap on the horizontal raceway or "bridge". The UDS shall be supplied with two (2) full height vertical riser/base combinations and shall consist of raceway sections not exceeding 16'-0" in length with adjustable tubular supports for each increment. The "bridge" raceway system shall be mounted at its base at no higher than 17" above finished floor (at the bottom of bridge) and shall not exceed 54" in height at peak of "bridge" top.
5. The main riser shall enclose the main circuit breaker with disconnect handle and shunt trip coil for fire/fuel shut-off. The main riser shall also enclose all switches, relays, solenoid valves and terminal blocks necessary for fire/fuel shut down of the equipment and shall be factory-wired in accordance with the national electric codes (NEC). Doors on main riser shall be hinged. The main riser shall feed the ventilator lights and the internal power connections via a load center. The main 3-phase electrical service is to be distributed to individual point-of-use circuit breakers wired to the equipment receptacle to be controlled or direct connection portal. Applicable receptacles shall be GFCI protected. The primary riser end access door shall be a full-height door mounted on stainless-steel hinges and shall be secured with a corrosion-resistant twist latch-closing device. The main breaker, emergency shut-down switch, ventilator light switch, convenience receptacle and equipment status lights shall be mounted on the primary riser end access door. The removal of access plates to individual electrical compartments to service these items will not be acceptable. The main breaker, emergency shut-off switch, ventilator light switch, convenience receptacle and equipment status lights shall be clearly engraved on plastic laminated labeling, which is mounted to the front of the access door. The access door on the end of the main riser shall be hinged. The ventilator light switch will have a spring hinged weatherproof protected clear cover with gasket. Light switch must be located at eye level. Main access door shall be designed so it cannot open unless the main power for the unit is turned off. Access to the primary plumbing utility connection inlets shall be by way of side lift-out panels on the side of the riser. The use of latches or screws to keep lift out panel in place will not be acceptable.
6. The secondary riser to be similar to the main riser except there is no electrical load center. There is to be a general use GFI convenience duplex receptacle mounted in a weatherproof box. Access to primary utilities is by way of a side lift-out panels on both sides. The use of latches or screws to keep lift out panels in place will not be acceptable.
7. The utility distribution system shall be sized and installed as per the NEC and color coded and pre-wired for easy Interconnection. Hardwire electrical cable shall be 100% copper insulated, color coded cables. The bus bar shall be 100% copper, insulated, using bonding lug or pre-drilling approach for future connections. The use of load centers or hardwired systems will not be accepted. Breakers are to be Square D brand or equal US manufacturer, thermal magnetic style, with 10,000 A/C ampere inrush capacity. All branch circuit breakers shall be sized according to equipment load and shall be clearly labeled to identify volts, phase, amps and connection number (per UDS equipment schedule). A corresponding status light shall be located within the main riser door for each circuit breaker. At the side of the horizontal race-way, receptacle connection plates shall be located which are individually grounded to the system main frame. Each connection plate shall be common and interchangeable and shall be furnished with a moisture resistant cover and grounding type receptacle having a specific NEMA polarized configuration. Field joints at risers and raceways shall be provided with quick disconnect snap plug-ins for easy reconnection of control wiring. Cord and plug sets with lock-able strain relief devices shall be furnished for ALL equipment items specified.
8. Connection points for the surface fire protection shall be provided for fire shutdown of the electrical system as required by NFPA 96.
9. Access to the plumbing compartment shall be by way of side lift-out panels on the plumbing compartment. The use of latches or screws to keep lift out panels in place will not be acceptable. Hot and cold-water supply lines shall be hard drawn type "L" copper insulated with 1/2" thick cellular foam insulation throughout. System to include a main quarter-turn manual shut-off valve in one vertical end riser. All piping and piping manifolds within riser shall be in-stalled with unions. For each piece of equipment,

provide hose connections as required. Each hose connection shall be provided with a quarter-turn ball valve and two-way disconnect coupling. Each field joint shall have unions for easy re-assembly at the job site. A combination pressure/temperature gauge shall be provided for the hot water line. Shock arrestor shall be provided and installed at the hot and cold-water supply inlets to the UDS. Each water connection to the cooking equipment shall be provided with a brass ball valve and stainless-steel flexible hose covered with antimicrobial protective PVC. All plumbing outlets shall be clearly labeled and color-coded for identification at each access location. Dedicated water filtering systems for equipment served by the UDS shall be pre-plumbed in the factory for ease of installation in field (Filters by KEC) unless filters are called out to be equipment and non-UDS mounted on issued construction drawings.

10. Manufacturer shall interface all Utility Distribution System construction with exhaust hood/ventilator and fire suppression system and actual field measurements at job site. Provide inspection of installation at initial equipment start-up by qualified factory technician to insure that connections have been correctly made and that the unit is functioning properly. This item and the ventilator/exhaust canopy shall be provided by the same manufacturer.
11. Provide matching cord sets with receptacles, or pre-wired flexible conduit assemblies for each adjacent electrical connection. Provide security/safety restraining lanyard complete with stainless steel attachment brackets and PVC-coated steel multi-strand cabling for all mobile equipment served by the UDS. Must meet ANSI Z21.69 section 1.7.4 standard.
12. Remote status indicator lights.
13. Each adjacent water connection to have a commercial use N.S.F. approved poly coated flexible stainless-steel water or steam hose assembly, with quick disconnect assembly on one end. Mobile items shall have 48" long assembly, and fixed items shall have 36" long assembly as appropriate.
14. Project-specific shop drawings/submittals shall be prepared and submitted for review and approval by the prospective manufacturer. The hood manufacturer shall supply complete computer-generated submittal drawings including UDS & hood sections view(s), UDS & hood elevation view(s), and UDS & hood plan view(s) complete with specified equipment blocks/families within drawings. No generic block forms/facsimiles of equipment are allowed. These drawings must be available to the engineer, architect, and owner for their use in construction, operation and maintenance.
15. Start-up and training shall be included in system installation scope.

2.4 ELECTRICAL WORK

- A. For all fabricated equipment, furnish, install (and intertwine from load center) all outlets, switches, controls, conduit, service fittings and load centers as shown as specified for the specific fixture. Load centers shall be complete with individual "visi-trip" circuit breakers for each device built into or forming an integral part of the unit. Furnish to Division 26 a wiring schematic including circuit breaker diagram for load center.
- B. Insure that all equipment furnished under this contract shall be so wired, wound or constructed as to conform with the characteristics of electrical and other services at the premises.
- C. Appliances shall be new, of manufacturer's current production and furnished complete with motors drive mechanism and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electricity operated machines and for all fabricated equipment.
- D. All conduit wiring shall be run concealed wherever possible. Conduit shall be continuous from outlet to outlet and from outlet to load center circuit or pull boxes and shall center and be secured in such a manner that each system shall be electrically continuous throughout. All conduits shall be thoroughly and substantially supported by accepted industry practices.

- E. Supply on each motor driven appliance or electrical heating unit, a suitable control switch or starter of proper type wherever such equipment is not so built.
- F. All plug-in equipment shall have plugs and cords furnished and installed. Coordinate work with Division 26 so that the receptacles provided will match the specific plugs installed as part of the plug-in equipment. any changes on cords and plugs required in the field due to lack of coordination between Division 26 and Kitchen Equipment Contractor shall be the latter's responsibility.
- G. All surface mounted receptacles indicated for fabricated equipment are to have Component Hardware Model R58-1010 or equal aluminum box complete with satin finish stainless steel cover and receptacle as indicated below:
 - 1. 2-pole, 3-wire grounding 20 amp; 125 V.
Hubbell # 5352 or equal (NEMA 5-20R).
 - 2. 2-pole, 3-wire grounding 20 amp; 250 V.
Hubbell # 5461 or equal (NEMA 6-20R).
 - 3. 2-pole, 3-wire grounding 30 amp; 250 V.
Hubbell # 9330 or equal (NEMA -30R).
- H. All built-in receptacles indicated for fabricated equipment are to be 2" x 4" x 1-1/2" (50 mm x 100 mm x 38 mm) deep "Handy Box" tack welded to fixture and fitted with receptacle indicated above and satin finish stainless steel cover. Splash mounted receptacles to be horizontal with all other vertical.
 - 1. 30 AMP, 250 V receptacles require a 2-1/8" (54 mm) deep "Handy Box". If splash width to 2-1/2" (62 mm).
- I. All electrically heated, fabricated equipment shall be internally wired to a thermostatic control and an "on/off" red light indicator, both to be mounted in a terminal box with a removable access panel and located outside the heating area. Wiring to be nickel-plated copper, properly insulated.
- J. All cold storage room electrical components shall be provided with conduit, splice boxes, switches, fittings, etc. concealed within the insulated panels at time insulation is foamed in place. Conduit shall extend up within wall panels, through ceiling panels ready for EYS fittings and final connection by Division 26.
- K. Provide all incandescent/LED bulbs and fluorescent/LED tubes required for equipment under this section.

2.5 FABRICATED EQUIPMENT

A. Special Fabricated Equipment

All specially fabricated equipment must be by one manufacturer acceptable to Designer and the Owner.

B. Workmanship

All work must be done in an approved workmanlike manner to the complete satisfaction of Designer and Owner.

C. Stainless Steel

All stainless steel shall be the U.S. Standard gauge, 18-8, Type 304, finish as noted in Paragraph 2.5N. The exception for using Type 430 stainless steel shall be as noted in the itemized specifications.

D. Galvanized Steel

All galvanized steel shall be electro-galvanized.

E. Welding and Soldering

1. All seams and joints shall be shop welded or soldered as the nature of the material may require. Welds to be ground smooth and polished to match original finish.
2. Framework of galvanized steel shall be welded construction. Where galvanizing has been burned off, the weld shall be touched up with high-grade aluminum paint.

F. Sound Deadening

The underside of all metal to tables, counters, drainboards, sinks and dishtables shall have a hard drying NSF approved mastic, such as manufactured by component hardware, 1/16" (2 mm) minimum thickness. Exposed mastic will not be acceptable.

G. Metal Top Construction

1. All seams and joints shall be one-piece welded construction, reinforced on the underside with galvanized steel reinforcing welded in place so tops can support heavy weight without deflection. Cross braces to be not more than 30" (760 mm) on center.
2. Field joints in stainless steel tops; where required due to limitation of sheet sizes, equipment sizes or installation requirements shall be welded, ground smooth and polished to blend with adjacent surfaces.
3. If inverted hat sections are used in lieu of channels, close ends. All exposed sides, ends, etc. shall be stainless steel #4 finish.

H. Fasteners

1. Exposed bolt heads will not be permitted on fixtures.
2. Butt joints made by riveting straps under seams and then filled with solder will not be accepted.
3. Rivets of any kind, including pop-rivets, will not be accepted.
4. Exposed screw heads, when necessary, shall be one of the same materials as the pieces joined and counter sunk flush.

I. Rolled Edges

Rolls shall be as detailed with corners bullnosed, welded, ground and polished.

J. Corners

Dishtables, drainboards, splashbacks and turned up edges shall have 1/2" (15 mm) or larger radius bends in all horizontal and vertical corners, coved at intersections unless specified otherwise.

K. Enclosed Cabinet Base

Bases shall be made of 18-gauge stainless steel sheets reinforced by forming the metal. Sides and partitions shall terminate at front in a 2" (50 mm) wide fully enclosed mullion and welded at intersections. Shelves are to be removable where detailed. Exposed ends, partitions and shelves are stainless steel.

L. Legs and Cross Rails

1. Equipment legs and cross rails shall be 1-5/8" (40 mm) 16-gauge stainless steel tubing unless otherwise noted. All welds at cross rails shall be continuous and ground smooth. Tack welds are not acceptable. Tops of legs to be fitted with Component Hardware A20-0406 or A20-0206 leg sockets or approved equal. Gussets are to be welded to underside of sinks and bracing.
2. Bottom of legs to be fitted with Component Hardware A10-0852 adjustable stainless steel foot or approved equal. Foot plug to be welded, ground and polished. When flanged feet are specified, use Component Hardware O10-0854 adjustable stainless steel foot or approved equal.
3. Enclosed cabinet bases mounted on 6" (150 mm) high legs are to be equipped with Component Hardware 8048 Series adjustable stainless steel counter legs or approved equal, with mounting plate as required.

M. Metal Gauge

Unless otherwise noted in Itemized Specifications or Details, all gauges to be manufactured to the following minimum thickness:

<u>Stainless Steel USS Gauge</u>	<u>Decimal Thickness</u>	<u>Millimeter Thickness</u>
12	.1094	2.78
14	.0781	1.98
16	.0625	1.59
18	.0500	1.27
20	.0375	0.95

N. Materials

All fabricated items to be provided in gauge, metal type and finished per the following table:

<u>Description</u>	<u>Gauge</u>	<u>Metal</u>	<u>Finish No.</u>
<u>Dishtable, Table and Countertops</u>	14	S.S.	4
<u>Hat Sections/Channel:</u>			
Unexposed	14	Galvanized	---
Exposed	14	S.S.	4
<u>Counter Body:</u>			
Framework	14	Galvanized	---
Aprons, Partitions, Backs and Ends:			
(Exposed)	18	S.S.	4
(Unexposed)	18	Galvanized	---
Shelves	16	S.S.	4
Refrigerators			
Interiors	20	S.S.	2B
<u>Doors</u>			
Outside faces	18	S.S.	4
Inside faces	20	S.S.	2B
<u>Drawer Pans</u>			
General	20	S.S.	2B
Refrigerated	20	S.S.	2B
<u>Shelf</u>			
Wall Mounted	16	S.S.	4

<u>Description</u>	<u>Gauge</u>	<u>Metal</u>	<u>Finish No.</u>
Fixture Mounted	16	S.S.	4
Table	16	S.S.	4
Refrigerator		S.S. Wire	4
<u>Shelf Bracket (Exposed)</u>	14	S.S.	4
<u>Ducts</u>			
Exposed	16	S.S.	4-Weld
Dishmachine	20	S.S.	4-Weld
<u>Wall Flashing</u>	20	S.S.	4
<u>Equipment Legs & Cross Rails</u>	16	1-5/8" diameter S.S. tubing	4

O. Closure

Backs of all fixtures, splashback, shelves, etc., shall be closed.

P. Casters

Casters shall be heavy-duty, non-marking ball-bearing NSF approved type with greaseproof neoprene or polyurethane tires. Wheels shall be 5" (130 mm) diameter. Minimum width treads of 1-3/16" (30 mm). minimum capacity per caster 250 lbs. (115 Kg).

Q. Sinks

1. Fabricated sinks shall have corners same as for metal tops. One piece welded construction with bottom pitched to drains and double wall partitions. Multiple compartments shall have continuous exteriors. Openings between compartments or applied panel will not be accepted.
2. Sink insets shall be 16-gauge stainless steel welded as integral part of top.

R. Drawers

All drawer pans shall be 18-gauge stainless steel having all corners coved except where specifically noted otherwise. Pan to be mounted on fabricated 14-gauge stainless steel angel cradle frame. Frame to be supported on Component Hardware S52 or approved equal full extension slides with 200 lbs. (91 kg) capacity per pair. Pan to be easily removable without the use of tools. Drawer fronts shall be double pan type with sound deadening material. Drawer shall be self-closing.

S. Doors

1. All metal doors to be double pan type reinforced and stiffened to prevent flexing and filled with sound deadening material.
2. Sliding doors shall be mounted on large ball-bearing quiet rollers in 14-gauge stainless steel overhead tracks and be removable without the use of tools. Sliding doors shall be self-closing.
3. Hinged doors shall be flush type, mounted on heavy duty, stainless steel, lift-off hinges, or as specified.
4. When specified, pulls shall be Component Hardware P62-1010 or approved equal.

T. Hardware

1. All hardware shall be of heavy-duty construction and identified on shop drawings by manufacturer and model number and shall be subject to final approval by Designer.
2. All hardware shall be identified with manufacturer's name and model number so that broken or worn parts may be replaced.

U. Breaker Strips

All ice pans, ice bins, refrigerated pans and cabinets shall be provided with breaker strips where adjoining top or cabinet face materials to prevent condensation. Breaker strips shall be fastened with stainless steel, counter sunk screws. Pop rivets will not be acceptable.

V. Insulation

All refrigerator insulation shall be foamed in place polyurethane. Fiberglass insulation shall not be used. Heated areas shall have minimum of 1" (25 mm) of thick fiberglass/mineral wool 2-1/2" (62 mm) density blanket insulation. Cold areas shall be 1" (25 mm) thick as indicated on details or drawings. Insulation shall be bonded to all surfaces.

W. Refrigerated Items

1. All custom fabricated units to meet NSF-7 criteria.
2. All reach-in refrigerators and freezers with remote refrigeration systems shall be complete with thermostatic expansion valves at the evaporator.
3. Fabricated compartments, refrigerated shelves, plates, etc., shall be provided with a 20-gauge steel box to house expansion valves when valve is remote from evaporator. Install in base of fixtures or in a concealed position.
4. All refrigerated compartments shall be fitted with dial or digital type thermometers with chrome-plated bezels. Thermometers shall be adjustable and shall be calibrated after insulation.
5. Refrigerator hardware for fabricated refrigerator compartments shall be heavy-duty components. Hinges shall be self-closing. Latches to be magnetic edge mount type with cylinder lock unless specified or noted.
6. Refrigerated drawers shall be sized to accommodate two (2) 12" x 20" x 5" (Gastronorm 1/1) steam table pans side by side or as specified or shown on the drawings. Drawer pulls shall be Component Hardware Group, Inc. Model No. P60-1010 or as shown on the drawings. Drawer slides shall be Component Hardware Group S52 Series, 200 pound (91 Kg) capacity, with stainless steel bearings of length as required to suit drawer depth. Drawer front shall be double pan with 18-gauge stainless steel front insulated core and 20-gauge stainless steel back panel. Drawer frame shall be 14-gauge stainless steel.
7. Refrigerator door openings shall be sized to suit 18" x 26" bun pan or as specified or shown on the drawings.
8. Refrigerated bodies shall have extruded snap-on matte gray breaker strip at door and ingredient pan openings. Provide Component Hardware Group PTC T12-5000 Condensate Evaporator complete with wall mounting hardware.
9. Shelves shall be stainless steel wire installed on stainless steel removable keyhole type pilasters.

2.6 MILLWORK EQUIPMENT

- A. All casework shall conform to the "Custom Grade" requirements of the Architectural Woodwork Institute (A.W.I.) Quality Standards, Section 400 for transparent finish.
- B. Plastic laminate facings: All plastic laminate facings shall be of color, pattern and texture by the manufacturer selected by the Architect and/or Interior Designer from standard range of samples.
 1. Plastic laminate in general shall comply with PL NEMA LD-3 10/HGS having a nominal thickness of 0.050. Where post forming material is required, it shall conform to PL NEMA LD-3 having a nominal thickness of 0.032.
 2. Core material shall be a minimum of 3/4" in thickness of veneer plywood as required by the manufacturer of the plastic laminate.

3. Cabinet liner shall have 0.20 balancing sheet shop bonded to core material on back surface using adhesive as specified by the plastic laminate manufacturer.
4. Construction details shall conform to the "Reveal Overlay" design as shown in the A.W.I. publication "Architectural Casework Details" and shall provide for a 3/4" vertical and horizontal reveal between all doors and drawers.
5. All exposed surfaces shall have plastic laminate finish. Semi exposed surfaces shall have a neutral color, 0.020 plastic laminate finish. All edges of doors and shelves shall be self-edged.
6. Joints shall be splined and fastened with tight joint fasteners to present a uniform flush surface.
7. Drawer interiors shall receive one (1) coat of penetrating primer and one (1) coat of gloss lacquer.
8. All fire retarding materials shall be treated with fire retardant chemicals to achieve a flame spread performance rating of maximum 25 (ASTM E84) as required by Code. Retardant chemicals must be of a type approved by local authorities.
9. Provide hardware items as required for a complete installation. Provide types as listed or equal.
 - a. Drawers and box drawers, up to 24" wide: Accuried 3832A.
 - b. Adjustable shelves with clips: Adjustable shelf supports (EDP type, unless otherwise noted) set in 5 mm holes spaced 32 mm on center.
Hafele America Co., No. 282.04.711
Hafele America Co., No. 282.24.13
 - c. Cabinet hinges: Concealed type, minimum 170o opening, self-closing.
Hafele America Co., No.326.05
 - d. Cabinet door and drawer pulls: Wire pulls; size and finish as selected by Architect.
Hafele America Co., No. 104.9.606
10. Any exposed interior or exterior surface, showing tool marks, bruises or other imperfections of any kind shall be corrected to the satisfaction of the Consultant prior to start up of the project.
11. Surfaces of all millwork not exposed to view, abutting walls or floors, shall be thoroughly back painted to limit moisture absorption.
12. Carefully cut backs of cabinets to fit plumbing rough-ins so edges of cuts will be concealed by the finish plumbing escutcheons.
13. Provide 3/4" thick access panels where required, fabricated as a door panel. Panel shall have two (2) magnetic catches at top and two (2) only 3/16" positioning pins at bottom.
14. Space between all units to wall, ceiling, concrete pads and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles or vermin. Sufficient material shall be allowed to permit scribing to walls and adjacent surfaces.
15. All installed work shall be scribed, trimmed, sealed, set plumb, square and level and firmly positioned, complete with all required fastenings, angle clips and braces, etc. as required to make the fixture rigid and secure.

2.7 STANDARD DETAILS

Standard Details included as part of drawings are to be considered guides to quality and scope of work involved. Where shop practices dictate, alternate construction methods and component items of equal manufacturer may be substituted. It will be the responsibility of the Kitchen Equipment Contractor to prove the quality of the proposed methods.

2.8 COLD STORAGE ROOMS

- A. Cold storage rooms shall be manufactured and installed in compliance with the Federal Energy Independence and Security Act of 2007 (HR6) and shall include:
 - 1. Automatic Door Closing Device
 - 2. Strip Curtains or Air Curtains on Hinged Doors
 - 3. R-25 Insulation in Cooler Walls, Doors, & Ceilings
 - 4. R-32 Insulation in Freezer Walls, Doors, & Ceilings
 - 5. R-28 Insulation in Freezer Floors
 - 6. High Efficiency Lighting and/or Automatic (Occupancy) Light Switches
 - 7. Double Pane View Windows in Coolers if specified
 - 8. Triple Pane View Windows in Freezers if specified
- B. All prefabricated cold storage rooms shall be manufactured by one manufacturer and installed by factory supervised installer.
- C. Interior finished ceiling height shall be 8'-0" (2440 mm) unless otherwise specified.
- D. Materials
 - 1. Insulation shall be non-burning urethane, foamed in place, not frothed or rigid board form.
 - a. Insulation shall be fluorocarbon filled (F-11) 95% closed cell content, nominal density of 2.0 pounds \pm 0.1 per cubic foot. Dimensional stability shall be from 45o F. (+7o C.) to 200o F.(93o C.).
 - b. Insulation shall have a thermal conductivity (K-factor) not to exceed (0.14 B.R.U./hour/square foot) as tested on ASTM C-177, at 75o F. (24o C.) mean temperature and an overall coefficient of heat transfer (U) not to exceed 0.029.
 - c. Classification: Each compartment shall bear a label "Class 1-Insulated Panel" as certified by an independent testing laboratory to have a surface burn spread 25 or less as determined by ASTM E84, UBC No. 9-1, Class A National Fire Protection Association N.F.P.A. Number 101, "Life Safety Code".
 - 2. Aluminum sheets used as a facia for wall and ceiling panels shall be stucco aluminum not less than .0404" thick.
 - 3. Stainless steel sheets used as a facia for wall and ceiling panels shall be 20-gauge. Other stainless steel shall be the gauge specified. All stainless steel shall be 18-8, Type 304, #4 Finish unless otherwise specified.
 - 4. Galvanized steel sheets used as a facia for wall and ceiling panels shall be prime finish, not less than 20-gauge complying with ASTM 525 and with G90 coating.
 - 5. Wall protection panels shall be Fiberglass Reinforced Polyester (FRP-X) Paneling 3/32" thick, embossed, white color or as specified with low smoke and less that 25 flame spread rating.
- E. Panel Construction
 - 1. Panels shall consist of precision die formed metal pans with 1/2" (50 mm) to 3/4" (76 mm) flanged perimeter, foamed in place urethane insulation between interior and exterior pans, thoroughly checked for gauge and shall be interchangeable with panels of like size. Metal pans shall be treated on the inside with a preparation coating of bonding agent to ensure a stable adhesion with the chemical bonding capabilities of the insulation.
 - 2. Wall and ceiling panels shall be 4" (100 mm) and 5" (127 mm) thick as required to comply with applicable codes and contain 100% foamed in place insulation and shall not have any internal wood or metal structural members. To ensure tight fitting joints, all panel edges shall have foamed in place urethane tongues and grooves and a flexible vinyl gasket foamed in place on the interior and exterior of all edges.
 - 3. Panels shall be rigidly coupled by a cam action hooked locking device. Locking device shall be foamed in place, maximum 48" (1200 mm) on center. Locking device shall be accessible from the inside to facilitate installation in confined areas and shall be provided with pressfit caps to close wrench holes. Joints between panels shall be sealed at

interior and exterior edges with a pvc gasket or an odorless nontoxic, synthetic polymerized sealant, to maintain continuity.

- a. Wall panels shall have a minimum of three (3) locking devices between each panel, located in the center, lower corner and upper corner.
 - b. Ceiling panels shall have a minimum of two (2) locking devices between ceiling panel and at wall panels, located at each corner of the wall panel. Ceiling panel joints shall be offset from wall panel joints.
 - c. Pre-fabricated floor panels shall have a minimum of two (2) locking devices between each floor panel and at walls, located at each corner of the wall panel.
1. All interior vertical corners shall be coved with a 1/2" (12 mm) radius.
 2. Exterior panels, interior partitions, corner panels, ceiling panels and "T" intersection panels shall be matching construction.

F. Wall/Ceiling Support System

1. Ceiling panels shall have a maximum deflection of 1/240 of the span under uniform loading of twenty (20) pounds per square foot. When the ceiling panels require a support system, the Manufacturer shall submit details and structural calculations to an engineer for approval prior to fabrication. A copy of the approved submittal shall be forwarded to Owner and Designer.
2. An indoor ceiling panel support system, when required, shall be furnished and installed using a hanger wire network attached to hanger brackets, designed to engage with the female lock pins imbedded within the roof panel foam core, spaced 4'-0" (1200 mm) on center.

G. Floor Types and Conditions

1. TYPE 1 – Insulated Depressed Building Floor with wearing surface (quarry tile or vinyl) as specified in architectural drawings to be as follows:
 - a. The floor shall be constructed at the jobsite in a depressed slab.
 - b. Apply asphalt emulsion to clean smooth depressed floor. Install Alumiseal Zero Perm vapor barrier, up sides of recess and lapped 6". Install cold storage room wall panels down into the bottom of the depression. Provide two (2) 2 1/2" (62 mm) thick layers of rigid board form urethane with staggered joints in depression over vapor barrier, installed after walls are in place.
 - c. On top of floor insulation provide a protective covering of 15 pounds felt. Overlap joints 6" (150 mm). Flash up sides to height of wall base.
 - d. When indicated on contract documents, finished floor outside the cold storage rooms shall ramp up 1/2" (12 mm) to the floor inside. The finished floor between cold storage rooms shall be ramped as well when indicated.
 - e. Concrete substrate topping and wearing surface to be provided and install as specified in Divisions 03, 07 and 09.
2. TYPE II – Pre-fabricated floor to be as follows:
 - a. The floor shall be pre-fabricated metal clad, foamed in place urethane insulated panels. Floor panel construction and insulation to be fully gasketed and to match that of wall and ceiling panels. Floor panels shall have a full integral cove with a minimum of 1/2" (12 mm) radius.
 - b. Wearing floor to be 1/8" (3 mm) thick diamond pattern aluminum tread plate over 3/4" marine grade plywood. When vinyl wearing surface is specified, provide 1/8" (3 mm) thick smooth aluminum plate in lieu of diamond plate. Tread plates shall be maximum size sheets available.
 - c. Exterior bottom face of floor shall be clad with 18-gauge galvanized steel.
 - d. Section lock parts, joints between floor panels and floor wall panels shall be filled with silicone sealant.
 - e. Interior/exterior ramps shall be furnished where specified and/or indicated on drawings.

H. Door and Door Frames

1. Door sizes shall be as specified, hinged as indicated on plan.
 2. Door shall be in-fitting, flush mounted, double pan 18-gauge stainless steel interior and exterior panels with foamed-in-place urethane insulation, 3" (76 mm) thick minimum, or as required by local code. Same construction as for wall panels. Corners of doors shall be Heliarc welded, ground and polished.
 3. Door frames shall be 18-gauge stainless steel. When exterior protection is specified the exterior door frame shall have raised exterior casing to form a stop.
 4. Furnish and install a removable threshold at each low temperature door, construction of 1/8" (3 mm) thick stainless steel with 2B finish.
 5. Provide a heating element on the ambient side of each door frame head, jambs and threshold. The heating element shall be a dual 120-volt, 240-watt with thermostatic control, factory pre-wired to a "GS" splice box located above the door on the interior. Manufacturer shall provide a 1-1/4" (30 mm) diameter hole in the ceiling panel with a loose escutcheon through which Division 26 shall make final connection.
 6. Gasket shall be extruded polyvinyl chloride with vulcanized corners and continuous magnetic core at sides and top of door frame. The stainless steel jamb facing shall extend to protect the gasket.
 7. When a cold storage room has a door to both the storage/receiving area and the issue area, the lock on the storage/receiving door shall be blank on the inside, without inside release. The lock on the issue side shall be as specified in Paragraph 10.
 8. Door shall be adjusted to be self-closing after installation and floor is finished.
 9. Sill wipers for Type 1 floors shall be adjustable, extruded neoprene secured by removable stainless steel retainer strip and fasteners.
 10. Each hinged door shall have:
 - a. Kick plate of 14-gauge stainless steel 2'-0" (600 mm) high and full width of door. Mount on interior and exterior face of each door.
 - b. Hinges, three (3) each per door, shall be cam lift, zinc die cast and polished chrome plated. Doors 42" (1065 mm) wide and wider shall have four (4) hinges. Hinges shall be Kason #1346.
 - c. Latch shall be heavy-duty chrome plated brass with adjustable keeper, interior safety release and provisions for padlocking. Padlock by others.
 - d. Hardware shall be mounted with 12-gauge reinforced steel tapping plates and machine screws.
 - e. Heated viewport approximately 10" (254 mm) wide by 15" (381 mm) high, minimum triple thermopane glass. Viewport wiring to be concealed within door section.
 11. Door section shall be self-supporting constructed similar to wall panels with 4" (100 mm) foamed in place urethane core and 12-gauge steel reinforcing. No wood frame will be permitted. Jambs and headers shall be 18-gauge stainless steel with steel backing in full perimeter.
- I. Light Fixtures and Switches
1. Quantity of 48" LED light fixtures shall be as indicated on the electrical plan. Provide Kason model 1810LX4000 4' LED with SMD Diodes.
 2. Light fixtures shall be ceiling mounted; cast aluminum; fully enclosed; gasketed; vapor tight; weather tight; with shatterproof, heat resistant diffuser; and junction box.
 3. Light fixtures shall be three-way or four-way, AC, pre-switch, mounted in recessed "FS" boxes with gray Hypolan, weatherproof plate, press switch cover and unbreakable red plastic pilot light lens constant burning on interior and indicating on exterior.
 4. Cold storage rooms with doors at each end shall have three-way switches on the exterior and four-way on the interior.
 5. Light fixtures shall be factory mounted on the latch side of doors and pre-wired with rigid conduit and wiring run within the wall panel, terminated in a vapor tight splice box mounted on the interior wall near ceiling. Manufacturer shall provide a 1-1/4" (31 mm) diameter hole in ceiling panel with a loose escutcheon through which Division 26 shall make final connections.

6. Alternate Light Fixtures: When ceiling mounted light fixtures cannot be used, the following light fixture shall be used.
 - a. Light fixture shall be Kason 1808NM0000 vapor-proof with cast aluminum junction box and fixture body, gasket, plastic coated globe and lamp.
 - b. Light fixture is mounted in the door section wall panel. Fixture shall be factory mounted and pre-wired to light switch with galvanized steel nipple terminated at exterior face of the ceiling panel.
- J. Digital Thermometer and Alarm
 1. Digital thermometer and alarm shall be furnished for each cold storage room.
 2. Digital thermometer and alarm shall consist of solid state audio alarm, silence button, trouble light, digital read out contacts to tie into building monitoring system and stainless steel cover.
 3. Digital thermometer and alarm shall be flush mounted with stainless steel cover plate, mounted on the latch side of the door on the exterior of each cold storage room, pre-wired with rigid conduit and wiring run within the wall paneling using "FS" recessed box on the exterior and terminated in a "GS" splice box mounted on the interior near the ceiling. Manufacturer shall provide a 1-1/4" (31 mm) diameter hole in ceiling panel with loose escutcheon through which Division 26 shall make final connection.
 4. When the door does not open into an ambient area, the digital thermometer and alarm shall be factory installed, as specified above, in a remote wall panel with an ambient face that will not interfere with other equipment and functions and identified with a name plate of the room being monitored. The sensor capillary shall be extruded as required and, when necessary, run in electrical conduit. Provide escutcheon plates on each side of each partition penetrated.
- K. Door Fan Switch
 1. Door fan switch shall be provided for each low-temperature cold storage room, when it opens into a non-refrigerated area, to shut-off evaporator coil from fan motors when the door is opened.
 2. Door fan switch shall be factory mounted on the door jamb and pre-wired with rigid conduit and wiring within the wall panel to a splice box located on the interior near the ceiling. Manufacturer shall provide a 1-1/4" (31 mm) hole in ceiling panel with a loose escutcheon through which Division 26 shall make interconnection to the evaporator coil(s) fan motors.
- L. Interior/Exterior Wainscot
 1. When specified, wainscot shall be FRP-X panels, 4'-0" (1260 mm) wide by 3'-0" (915 mm) high. Exposed face of panels shall be clad with galvanized steel. Panels shall be applied in the field using a full bed of contact adhesive prior to the installation of the quarry tile top set base.
 - a. Wainscot panels shall be stopped short 1" (25 mm) from inside corners. The top edge and all exposed vertical edges shall have matching "J" end cap molding. Joints between panels shall have matching "h" divider molding. Molding shall be installed with silicone sealant per the manufacturer's direction to assure a moisture proof installation. Vertical molding shall NOT be run behind quarry tile top set base. Height of tile base to be verified with General Contractor.
 - b. Corner guards shall be furnished on all outside corners. Corner guards shall set on top of the quarry tile base.
 - c. Trim for inside corners shall be 2" (50 mm) by 2" (50 mm) coved white stucco aluminum by height of wainscot from the top of the quarry tile base.
 - d. Manufacturer and color shall be the same as the FRP-X furnished under Division 09 for the building walls in the foodservice areas.
- M. Full Height Interior/Exterior Protection

When specified, full height protection shall be FRP-X panels, 4'-0" (1200 mm) wide by 8'-0" (2440 mm) high. Exposed face of panels shall be clad with galvanized steel. Panels shall be applied in the field using a full bed of contact adhesive prior to the installation of the quarry tile top set of base.

1. Top edge when not covered and exposed vertical edges shall have matching "J" end cap molding. Joints between panels shall have matching "H" divider molding. Molding shall be installed with silicone sealant per the manufacturer's directions to assure a moisture proof installation. Vertical molding shall not be run behind the quarry tile top set base. Height of the base to be verified with the General Contractor.
2. Trim for inside corners shall be 2" (50 mm) by 2" (50 mm) coved white stucco aluminum full height from the top of the quarry tile base.
3. At exterior when support of the end of the FRP-X panel is required due to the width of the space, a full height galvanized steel angle shall be fastened to the wall to support the free end of the panel. FRP-X shall be glued to angle.
4. Trim for inside corners shall be 2" (50 mm) x 2" (50 mm) coved white stucco aluminum by height of wainscot from the top of the quarry tile base.
5. Manufacturer and color shall be the same as the FRP-X furnished under Division 09 for the building walls in the foodservice area.

N. Closure Panels

1. Closure panels shall be furnished and installed to close the space between the exterior top of the cold storage room and the finished ceiling of the building.
2. Panels to match exterior panel finish. Panels to be lift-out type with side turned into form a pan. At ceilings, securely fasten and angle for panel to slip into. Channel and angle to match panel material.
3. When exterior finish is FRP-X, the closure panel shall be white stucco aluminum.
4. When area does not have a finished ceiling, closure panels will not be required, unless otherwise specified or required by the Health Department.

O. Trim

1. Vertical trim strips and angles to match cold storage room exterior finish. Trim to be applied with adhesive tape and a minimum of exposed fasteners to fully seal cold storage room adjacent walls, etc.
2. The FRP-X paneling with a "J" end cap molding is to be extended past the end of the cold storage room wall to the building wall and caulked with silicone as required.

P. Ramps and Sills

Ramps and sills when required shall be pre-fabricated 16-gauge stainless steel ramps with 14-gauge galvanized reinforcing and urethane foamed in place insulation. Wearing surface to have 4" (100 mm) wide non-skid strips. See specifications and drawings for size and shape. All door sections shall be provided with minimum 14-gauge stainless steel sill plate complete with heater cable as stated under door section. Sill to be either built into ramp/pre-fabricated floors or to be part of door section on insulated depressed building floors. Sills to be removable for replacement of heat cable.

Q. Utility Penetrations

1. Provide openings in ceiling and wall panels to accommodate all electrical, refrigeration and drain lines.
2. Seal all openings with silicone after lines have been run and before installation of escutcheons.

R. Escutcheons

1. Provide sufficient quantity of 5" (127 mm) diameter blank stainless steel escutcheons to trim all interior and exposed exterior penetrations.

2. Provide cutting of proper size hole in blanks and panel penetrations.

S. Pressure Relief Vent

1. Pressure relief vent shall be factory installed at each low-temperature cold storage room door.
2. Pressure relief vent shall be electrically heated, 120 volt and have aluminum screen.

T. Corner Guards

1. Corner guards on the exterior outside corners shall be 4" (100 mm) x 4" (100 mm) x 48" (1200 mm) 16-gauge stainless steel secured to wall panels with a full bed or contact adhesive. When FRP-X is specified, corner molding shall be omitted behind the corner guard.
2. Corner guards on the interior outside corners shall be 2" (50 mm) x 2" (50 mm) by height of wainscot or 48" (1200 mm) high 18-gauge stainless steel secured to wall panels with a full bed of contact adhesive. When FRP-X is specified, outside corner moldings shall be omitted behind corner guards.

U. Divider with Gate

Divider and gate when specified should be aluminum expand-x where indicated on drawings.

1. Panel mesh shall be flattened aluminum expand-x heliarc welded to aluminum frame.
2. Frame shall be 1-1/2" (38 mm) x 1-1/2" (38 mm) x 1/8" (3 mm) aluminum 6061-T6 angle. Frame shall have 3" (76 mm) space at bottom and 6" (152 mm) space at top.
3. Horizontal stiffeners shall be 1-1/2" (38 mm) x 1-1/2" (38 mm) x 1-1/8" (28 mm) aluminum angle.
4. Floor plates shall be 3" (76 mm) x 3" (76 mm) x 14" (356 mm) aluminum heliarc welded to angle posts.
5. Gate shall be of same construction as divider, 2'-10" (864 mm) wide with lock similar to that specified for insulated doors.

V. Rub Rails

Rub rails when specified shall be located where indicated on plans.

1. Rub rails shall be continuous lengths of 18-gauge stainless steel "V" shaped hat section secured to wall with two (2) faced tape and stainless steel sheet metal screws 19" (457 mm) O.C. Exposed ends shall be bevel cut, capped, welded, ground and polished.

W. Strip Curtain

Strip curtain shall be provided on all doors and shall be Kason E2 mount with 50% door strip overlap or equal.

X. Door Locking Bars

1. Door locking bars, when specified, shall be 1/8" (3 mm) by 2" (50 mm) stainless steel two-piece, hinged and secured at each end with interior safety release. Bar shall swivel and where the ends meet in the center shall have a 2" (50 mm) long 90o "L" drilled to receive padlock, padlock by others.
2. When a door locking bar is specified, the latch specified in Paragraph H.10.c shall be replaced with a Kason Model 577 polished chrome plated door pull.

Y. Identification Signs

1. At exterior of each Cold Storage Room (s) provide and permanently affix engraved plastic name plates with maximum 3/4" (18 mm) high letters and number identifying each Cold Storage Room and Refrigeration Systems to match "as built" diagram. Name plate to be mounted with adhesive below respective digital thermometer alarm. A similar name plate

with 1/2" (12 mm) high letters is to be installed in a like manner on the evaporator coil(s) at all other items having a remote refrigeration system.

2.9 REMOTE REFRIGERATION SYSTEMS

- A. All refrigeration systems shall be manufactured and installed in accordance with the Federal Energy Independence and Security Act of 2007 (HR6) and shall include:
 - 1. High efficiency motors on condensing units and evaporator fans.
 - 2. Efficient defrost systems on walk-ins with glass doors.
- B. All remote refrigeration systems shall be furnished and installed by one contractor, unless otherwise specified.
- C. Compressor and Condensing Units
 - 1. Units shall be factory assembled complete with selected air or water-cooled condensers best suited to match BTU load, high-load pressure controls, suction accumulator on low temperature system, sight glass, liquid line dryer, suction and discharge service valves, liquid receiver, and electrical control panel. The electrical control panel shall be furnished with magnetic motor starter, defrost timer clock, and contactors in accordance with "Refrigeration Schedule". Compressor capacities shall be based on Air Conditioning and Refrigeration Institute (A.R.I.) Standards.
 - 2. Capacities shall be based on the following:
 - a. Compartment temperature and evaporating temperature greater than 32o F. (0o C.) 18 to 20 hours operation.
 - b. Compartment temperature greater than 32o F. (0o C.) and evaporating temperature less than 32o F. (0o C.) 16 hours operation.
 - c. Compartment temperature and evaporating temperature less than 32o F. (0o C.) 18 hours operation.
 - 3. Condensing units shall be mounted on a steel base to effect a quiet operation. All rotating parts to be carefully balanced for minimum vibration and lubricated with forced or splash oil system. Receiver shall be sized for a complete pump down of the system and shall be shell type with fusible plug.
 - 4. Compressor units to be provided with suction and discharge back setting type service valves and standard machinery finish.
 - 5. Motors shall be single speed, maximum 1750 R.P.M. compound wound ball bearings or sleeve. Double squirrel cage motors with high starting torque set and low starting current to be used in a 3-phase application.
 - 6. All machines to be equipped with quick acting type high-low pressure control switches having adjustable range and differential and high pressure cutout. Cutout to be automatic reset type. For air-cooled units the condenser shall be a standard manufactured part of the equipment. Condensing temperatures shall be based upon (100o F., 38o C.) ambient air.
 - 7. Other components and accessories, such as suction filter and crank case heater shall be furnished when specified in the itemized specifications.
- D. Motor Starters – Contactors
 - 1. All single-phase motors shall be provided with mounted and internally wired contactors, except where pre-wired units are furnished without contactors. Single-phase compressors shall be provided with built-in thermal and electrical overload protection.
 - 2. All three phase motors shall be provided with magnetic type starters with quick trip overload elements matched for motor amperage except where overload protection is built into the compressor motor and the manufacturer supplies a contactor instead of a starter. Overload heater element shall be size according to manufacturer's recommendations. Compressor motor starters shall be definite purpose starters with manual reset.

3. Starters shall be installed upon surfaces free from excessive vibrations.
 4. Where starters are required for installation in a motor control center, make and model of control center shall be verified and starters provided to match.
- E. Oil Separator
1. Provide oil separators, except when compressor manufacturer requires otherwise, 34o F. (1o C.), and below and install as near as possible to the compressor. The return line shall be connected to the top of the crankcase above the oil level. Where compressor does not have connection for oil return line from separator, connect to a tee in the suction line adjacent to the compressor. Exposed oil return line to be provided with shut-off valve of the pack-less stem type.
- F. Compressor Racks
1. Racks shall be of the number of tiers and quantity to accommodate the number of condensing units specified for each rack assembly and allow for service clearance and ventilation.
 2. Racks shall be fabricated with structural steel of size and quantity to properly support the equipment to be installed on the rack.
 3. Racks shall be all welded construction with welds ground smooth.
 4. After completion of fabrication the complete rack shall be cleaned, primed and painted with top quality oil base enamel.
 5. Each rack shall be equipped with a pre-wired duplex outlet.
 6. Racks shall be pre-wired to a circuit breaker panel and pre-plumbed to a header (when specified water cooled) requiring a single point electrical and plumbing connection.
 7. Racks shall have UL or equivalent approval.
- G. Coils and Cooling Units
1. Units shall be direct expansion type of size and design to effect required temperature, humidity and to suit application intent. Units shall be furnished and installed in accordance with the "Refrigeration Schedule".
 2. Units shall be hung from the ceiling with 1/2" (12 mm) nylon rods with plated steel nuts and washers. Rods shall extend through ceiling to bracing adequate for the suspended weight. Bracing shall be furnished as required; penetrations shall be sealed and trimmed with escutcheon plates.
 3. Units shall be installed tight to ceiling. All installations adjacent to walls shall be set out a minimum distance conforming to manufacturer's directions, to ensure proper air circulation and performance.
 4. Units with fan or blower and motor shall have thermal overload protection and be wired as indicated in the "Refrigeration Schedule".
 5. Defrost cycle shall be based on the following:
 - a. Coils for 32o F. (0o C.) and lower shall have an electric defrost mounted as part of the coil.
 - b. Coils for 33o F. (0.6o C.) and 34o F. (1o C.) shall have defrost as part of the coil.
 - c. Coils for temperature above 34o F. (1o C.) shall have an air defrost in the off cycle controlled by proper sizing of the coil and the compressor.
 6. Location of coils shall be coordinated with shelving and floor sink locations. Where coils protrude into aisle ways clear to height to be minimum 6'-6".
 7. All coils for fabricated refrigerators/freezers shall be installed for accessibility and replacement.
- H. Penetration Sleeves and Plates
1. Service line penetrations of insulation to accommodate electrical conduit, refrigerant and drain lines shall be limited to a minimum with service stubbed through insulation or locations pre-determined by respective divisions.

2. Where service lines penetrate insulated walls, the opening shall be packed with caulking, before trimming with escutcheon plate.
3. All exposed ends of sleeves, both inside and outside of compartments, are to be trimmed with 24-gauge stainless steel escutcheon plates, furnished as blanks in which respective work divisions shall cut required line holes and install.

I. Refrigerant Piping

1. Copper tubing for refrigerant piping shall conform to ASTM standard specifications, serial designation B-88. All piping shall be Type "L" ACR hard copper or cleaned and sealed soft Type "L" tubing, dry seal or equal as indicated. Forged or wrought copper fitting with sweat or soldered joints shall be used.
2. Tubing shall be cut only with a tube cutter and sized with a sizing tool.
3. Piping shall be exposed to view as required by the standard safety code for mechanical refrigeration.
4. The liquid suction lines from condensing units to coil shall be sized and run as shown on the "Refrigeration Schedule" and Refrigeration Drawings.
5. Piping run within cold storage rooms shall be finished with aluminum paint.
6. For exposed areas, accessible furred ceiling spaces and walls or excavated trench type installations, hard copper tubing shall be used. Exposed tubing shall be run in a manner to preclude damage by activities in the area; or shall be protected by conduit, furnished and installed as a part of this contract. Conduit shall have water evacuated and both ends completely sealed.
7. For piping run in conduit through inaccessible areas, such as under slab on grade, soft copper tubing shall be used. In lieu of large piping in conduit, especially vertical runs, random lines may be used; carefully fabricated and assembled to ensure equal pressure drop.
8. Ends of lines shall be capped to prevent contamination and opened only at time of final connection.
9. Suction lines shall be sized for a maximum pressure drop from evaporator to compressor 2 lbs. (0.9 kg.) for high and medium temperature systems, and of 1 lb. (0.45 kg.) for low temperature systems and shall allow gas velocities of not less than 750 FPM (3.8 M/sec) in horizontal runs and 1500 FPM (97.6 M/sec) in vertical risers. Liquid lines shall be size for a maximum pressure drop of 3 lbs (1.36 kg.) from receiver to evaporator.
10. Tubing lines shall be graded or pitched to prevent trapping of oil. Suction lines shall pitch 1/2" (12 mm)/10'-0" (3048 mm) minimum.

J. Joints and Connections

1. Fittings shall be long radius wrought copper only as manufactured by Mueller Brass Company.
2. Vertically run suction lines shall have oil "P" traps constructed of two (2) 45o ells and (1) 90o ell, or one (1) piece Mueller "P" trap, of the same size as the vertical lines.
3. 1/8" (3 mm) NPT by 1/4 fl. Half union for all suction and discharge service valves with 1/4 fl. cap.
4. Reduction in piping size shall be made with a manufactured reducer coupling.
5. Flare nuts shall be short forged or frost proof.
6. All surfaces to be joined must be prepared and cleaned. When soldering stop of solenoid valves, wrap valves with moist fabric to absorb excessive heat. Stop valves shall be partly open. When soldering expansion valves or pressure regulating valves, remove power assembly, if necessary, to prevent damage by excessive heat.
7. Copper joints shall be made with Handy & Harmon "Sil-Fos" brazing alloy, "Phoson 15", "Silvaloy 15" or equal; melting point of 1185o-1350o F. (607o-618o C.) silver content not less than 15%.
8. Copper to brass joints shall be made with Handy & Harmon "Easy Flo 45" brazing alloy "Silvaloy 45", "Mueller 122" or equal; melting point of 1125o-1145 (607o-618o C.) silver content not less than 45%.

K. Hangers and Supports

1. For all piping not run in conduit, provide adjustable hangers, anchors or straps as required. Hanger spacing shall not exceed 8'-0" (2400 mm).
2. Insulated copper tubing shall be provided with approved type sleeves at hanger points.
3. All insulated copper piping shall be isolated from supports by means of felt wrapping or with "Trisolater" by Semco or approved equal.
4. Vertical piping shall be supported at intervals with spring type hangers or a substantial pipe at case of the pipe. All horizontal pipe runs connected to vertical risers must be adequately supported.
5. For suspended conduit, support shall be by means of hanger permitting screw adjustments. Sufficient hangers shall be used to provide support, allow expansion and limit vibration.

L. Piping Sleeves

1. Provide sleeve through walls which allow for fully insulated lines. Extend sleeves entirely through wall and dress each end with a chromium plated wall plate neatly fitted against the wall, securely fastened and sealed in place. All sleeves through wall shall be of standard weight steel pipe.
2. Piping lines and sleeves at wall or floor penetrations shall be caulked and made vermin-proof at all locations.

M. Piping Insulation

3. Suction lines run in conduit shall be insulated according to ambient and humidity conditions to prevent condensation and freezing.
4. Refrigeration suction lines outside of refrigerated compartments, not run in conduit, shall be insulated back to compressors with Armstrong Armaflex AP foamed plastic insulation or as determined by code. Thickness of material shall suit service, ambient and humidity conditions, to prevent condensation, minimum thickness 1/2" (15 mm).
5. Cold Storage Room freezer drain lines extended through adjacent cooler compartments shall be insulated with 1/2" (15 mm) minimum thickness of Armstrong Armaflex AP foamed plastic insulation to prevent condensation. Carefully seal end of insulation tight against cooler wall surface.
6. Piping for cooling water services or refrigerant piping exposed to freezing ambient temperatures shall be insulated with 1/2" (15 mm) thickness of Armstrong Armaflex AP foamed plastic insulation. Paint exterior installation with Armaflex paint.
7. Thickness of material shall suit service, ambient and humidity conditions to prevent condensation.
8. Joints shall be sealed with Armstrong 520 adhesive. Insulation shall be continuous through clamps. Provide additional insulation where suction lines must be run within 12" (300 mm) or less of water or underground waste lines.

N. Heat Interchangers

All blower control, unit coolers, plate type evaporators and other evaporators where specified, are to be provided with heat interchangers as manufactured by Dunham-Bush, Inc., with a capacity to match the condensing unit.

O. Temperature Control

1. Temperature control of cold storage rooms shall be by line voltage thermostats operating liquid line solenoids.
2. Temperature control for remote normal temperature refrigerator shall be by low-pressure switch setting.
3. Temperature in each cold storage room compartment shall be controlled by electric thermostat, Ranco No. 010-1408, located within compartment and sensing element positioned to avoid fan discharge air stream.

P. Valves and Accessories

1. All valves and controls shall be standard weight and suitable for service purpose intended, and subject to approval by the Designer.
2. Each system shall include condensing unit with standard valving, refrigerant piping, refrigerant, evaporator(s), liquid and suction line isolation valves within 5'-0" (1500 mm) of evaporators, thermostatic expansion valve for evaporator, heat exchanger, filter-dryer, liquid line solenoids for Cold Storage Rooms and liquid indicator.
3. Vibration eliminators on compressor suction and discharge lines, size same as piping, as manufactured by Anaconda.
4. Refrigerant shut-off valves shall be as manufactured by Henry or Superior Valve Company. Valves shall be placed in liquid line for each condensing unit and in each liquid line to each evaporator.
5. Expansion valves shall be Sporlan, furnished and installed in the liquid line at the evaporator, unless provided with manufactured equipment. External equalizer expansion valves shall be provided for coils fitted with refrigerant distributor.
6. A Sporlan drier shall be provided at the compressor. Up to 3 HP shall be a Catch-All series; larger than 3 HP shall be angle replaceable cartridge series.
7. Each liquid line sight glass shall be Sporlan "See All" moisture and liquid indicator and shall be full line size.
8. Solenoid valves shall be Sporlan line voltage, manual lift system type, to operate at maximum of 2 lbs (0.9 kg) pressure drop across the valve. Valves shall be full line size, using silver solder connection as applicable. A liquid line solenoid, normally closed, shall be used with temperature controller for each Cold Storage Room compartment coil on a system.
9. Include a suction line filter with access valve adjacent to compressor. Filter shall be a Superior "F" Series or equal.
10. EPR, CRT, and/or CDA valves shall be Alco or Sporlan.
11. Suction accumulators shall be Refrigeration Research 3700 series or Virginia CA series.
12. Discharge line mufflers shall be Refrigeration Research M-10 and M-15 or AC and RS S-6300 series.
13. Time clocks shall be Paragon.

Q. Drain Lines

Type "L" copper coil drain lines extended to exterior of refrigerated compartments over floor sinks (drain) with "S" traps at termination ends.

1. Provide clean out "T" and cap at each change of direction in the lines. Provide individual drain lines for each coil unless otherwise specified. Drain lines shall be run tight to refrigeration compartment walls with minimum pitch of 2" (50 mm) per foot.
2. Drain lines inside low temperature compartments shall be equipped with drain line heaters and insulated with Armaflex 1/2" (12 mm) insulation. Drain lines in low-temperature compartments shall be extended into adjacent, medium or high temperature compartments to reduce length of drain line heater required.
3. Drain lines on the exterior of refrigerated compartment shall be painted with chrometone paint.

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Delivery

1. The equipment shall be delivered and installed on schedule. Coordinate all work with the General Contractor and other divisions as required.

2. Extra charges resulting from special handling or shipment shall be paid by the Kitchen Equipment Contractor if insufficient time was allowed in placing factory orders to ensure normal shipment.
- B. The work shall be accomplished so as not to delay the project construction schedule, interfere or conflict with the work being performed by other contractors. Work shall be coordinated and integrated to prevent conflict of work necessitating changes to work already completed. Should conflicts occur, notify the Owner for his coordination in its resolution.
- C. Verify all field dimensions before fabrication.
- D. Include all alterations to walls, floors and ceiling necessary for work, except otherwise shown or specified, accomplished in a manner satisfactory to the Architect and the Designer. Holes through structural beams shall be prohibited unless written approval has been granted by the Architect.
- E. Cut holes in equipment for pipes, drains, electric outlets, etc. as required for this installation. Work shall conform to highest standards or workmanship and shall include welded sleeves, collars, ferrules or escutcheons.
- F. Repair all damage to the premises as a result of this installation.
- G. Remove daily all debris from the site related to this installation.
- H. Remove any plates, components or component covers installed at the factory before installing the FRP-X panels at cold storage rooms and reinstall them afterwards along with the items furnished loose for mounting on the exterior face of the wall panels.
- I. Space between all equipment to wall, ceiling, floors, masonry pads, and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering or mastic. Mastic shall be General Electric Silicone Construction Sealant Series SE1200 in appropriate color.
- J. Trade marks and names of fabricator shall not be fastened to any items without the written approval of Clevenger Associates.
- K. All items shall be installed plumb, square, level and in proper elevation, plane location and in alignment with other work.
- L. Cold Storage Rooms
 1. The cold storage rooms shall be delivered and installed on schedule by factory supervised and approved installers. Coordinate the work with the General Contractor and other trades as necessary.
 2. Become fully familiar with the job site and the architectural drawings and specifications. Provide the necessary job site coordination with the various trades to insure job site conditions will meet the requirements of the cold storage rooms.
 3. Establish a time schedule with the General Contractor that will insure the job site coordination with the various trades to insure job site conditions will meet the requirements of the cold storage rooms.
 4. All work shall be designed and manufactured to comply with field conditions and fitted with proper joints and sections.
 5. During curing and cleaning of the wearing floors inside the cold storage rooms, the cold storage room doors shall be left open and the rooms well ventilated to prevent damage to the interior. "Keep Out" signs shall be posted at each open door.

6. After the installation of the cold storage rooms and prior to the installation of the wearing floor has cured, the cold storage room doors are to be closed and locked.
7. Where the floor is depressed or floorless, walls shall be anchored to the building floor with a concealed 18-gauge galvanized steel floor track with drive pins 2'-0" (600 mm) on center and sealed at interior and exterior edges with a bead of sealant.

M. Refrigeration Systems

1. Refrigeration systems and connecting piping shall be installed as indicated in contract documents in a manner that provides complete and operational systems and eliminates any noise and vibration being transmitted to any part of the building.
2. Piping shall be installed to permit normal inspection, service, removal of the condensing units and their components and view of sight glasses and allow expansion and contraction without damage to the system.
3. Extreme care shall be taken to keep the entire system clean and dry.
4. Nitrogen gas shall flow through piping being welded to prevent scaling. The Owner or Designer shall have the option of cutting a maximum of three (3) welded fittings to inspect for the proper use of nitrogen. The Kitchen Equipment Contractor shall replace fittings at his cost where scaling is present.
5. Suction and discharge line vibration eliminators shall be furnished and installed parallel to the compressor shaft and secured at outlet end as required to eliminate vibration in rigid piping.
6. All refrigeration lines shall be factory extended to one end of the compressor rack in a neat and orderly manner and shall be supported and anchored with "Unistrut" or equal clamps and channels. Ends of lines shall be capped against contamination.
7. Compressors and all accessories on the compressor rack shall be factory mounted and pre-wired to a main circuit breaker control panel with individual circuit breakers wired to a main breaker disconnect requiring a single power connection. All wiring shall be run inside a code approved raceway.
8. Condenser water supply and return header shall be factory pre-plumbed using hard copper tubing with shut-off valves for supply and return for each.
 - a. Provisions shall be provided for connection to city water for emergency use.
 - b. Verify water system pressure and provide all necessary components to insure proper operation of the water cooled system and the return of the water to the re-circulating system.
9. If in the opinion of the Kitchen Equipment Contractor, additional ventilation is required to ensure correct operating temperatures, he shall so state in a letter to Owner and/or Designer for evaluation and decision before installation.

N. Refrigeration System Instructions and Identification

1. Kitchen Equipment Contractor shall at each component of every system identify it with the letter/number shown on the Refrigeration Schedule. The identification shall be with black paint, decal, or other approved permanent method. Plastic tape labels are unacceptable. Identification shall be in an easily seen location.

O. Refrigeration Piping Testing

1. Notify Owner and/or Designer in advance when a test is being made and ready for inspection.
2. Each system shall be pressure tested for leaks. Tests for R-404A refrigerant shall be 300 p.s.i. on the high side and 150 p.s.i. on the low side. All valves shall be fully open during last test.
3. Tests are to be accomplished as follows:
 - a. Charge the systems with refrigerant through the port of liquid shut-off valves of the receivers to a pressure of 10 to 20 p.s.i.

- b. Add dry nitrogen, the supply of which shall be equipped with a pressure regulating valve to provide the specified pressure.
- c. Carefully test all joints for leaks using either a Halide torch or an electronic Halogen leak detector.
4. The Owner or Designer shall approve all tests.
5. Precautions shall be taken to disconnect the low pressure controls for protection of the bellows during testing.

P. Refrigeration System Evacuation

1. Advise Owner and/or Designer when the evacuation of the system is to start, so the procedures can be checked.
2. Evacuation shall be an Airserco, Stroke KC8R or Robinaire, 150021 vacuum pump with an indicating gauge registering pressure in microns. Pump shall be connected to the system with a 5/8" (15 mm) O.D. line or larger.
3. Evacuate both high and low sides to 500 microns. Break the vacuum with refrigerant to 0 p.s.i. evacuate high and low sides to 100 microns; and then break vacuum to 0 p.s.i. with the refrigerant to be used in the system.

3.2 START-UP & DEMONSTRATION

- A. All equipment under this section shall be cleaned and ready for operation at time building is turned over to the Owner.
- B. Provide a competent service representative to be present when installation is put into operation. He shall lubricate and put into proper operation all equipment and instruct the Owner's employees in the proper use and maintenance of all items in this contract and set up a maintenance schedule to be followed thereafter. Three (3) copies of the schedule shall be provided before final acceptance of the installation.

C. Refrigeration System Start-Up

1. Charge each system with the refrigerant specified in the Refrigeration Schedule.
2. All systems and controls shall be set and checked for proper operation at temperatures specified in the Refrigeration Schedule.
3. Check compressors for proper oil level. Refrigerant oil shall be Suniso 3G, inhibited only, delivered to job site in sealed containers. Oil shall be added to the system to maintain 1/4" (6 mm) to 1/2" (12 mm) sight glass.
4. Check all electrical circuits by Division 26 for compliance with the manufacturer's specifications. Division 26 shall make corrections to his wiring as required. The Kitchen Equipment Contractor shall be responsible for corrections in his wiring and/or components as required.
5. The manufacturer's requirements for lubrication shall be checked and followed before the operation of fan and pump motors, and/or associated equipment.
6. Furnish and install, where directed by the Owner, copies of the Refrigeration Schedule and Refrigeration Floor Plan, framed with a glass covering. The Refrigeration Floor Plan shall show the location of all ERP, CTR, and/or CDA valves, solenoid valves, and other controls for easy location and services.
7. Provide a set of "As Built Drawings" to Owner upon completing the installation. Drawings shall include refrigeration line runs and wiring diagrams. Drawings shall be submitted in the form of reproducible sepia's.
8. Review the refrigeration systems, operation, maintenance, emergency procedures, and proper service procedures with the Owner's Engineering Staff. Provide a competent serviceman who shall remain for a minimum of eight (8) hours during the first day of operations.

- D. Where concrete has been poured inside a low temperature cold storage room it shall be allowed to cure twenty-eight (28) days, minimum seven (7) days before starting the refrigeration system. After the curing period the temperature shall be brought down in regulated stages. The temperature shall be brought down as follows: to 40o F. (5 o C.) held twenty-four (24) hours; to 20o F. (-6o C.) held twenty-four (24) hours; and then to specified temperature.
- E. During start-up provide all required instruction for operation and maintenance of equipment, after one (1) year guarantee period.
- F. The fire suppression system shall be tested for the authorities in the Owner's presence. Certificates shall be obtained and provided to the Owner from the authorities and from the Fire Insurance Rating Bureau.
- G. After installation and hook-up, verify air volumes at each exhaust and make-up air duct. A report shall be submitted to the Owner of all readings. All incorrect air volumes shall be rechecked after adjustment.

3.3 MAINTENANCE SCHEDULE

- A. Provide operation and service inspections every ninety (90) days during the warranty period. Final inspection shall be performed thirty (30) days before warranty expiration. Any service or repair requirements shall be performed before the end of the warranty period.
- B. Copies of all warranty service calls and inspection reports shall be mailed to the Owner and Building Operations Engineer.
- C. The Owner may call an outside company at the expense of the Kitchen Equipment Contractor, if the Kitchen Equipment Contractor does not arrive within a reasonable amount of the called in response to an emergency call.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

PART 4 - EQUIPMENT

4.1 REGULAR MANUFACTURED EQUIPMENT

- A. Provide equipment with standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED EQUIPMENT

- A. Provide arrangement and configuration as shown on plans, elevations and standard detail drawings.

4.3 FOODSERVICE EQUIPMENT SCHEDULE

Item No.	Qty	Description
001	1	WALK-IN COOLER / FREEZER ASSEMBLY

002	4	MOBILE COOLER SHELVING
003	1	UNIT COOLER (COOLER)
004	3	MOBILE FREEZER SHELVING
005	1	UNIT COOLER (FREEZER)
006	1	SPARE NUMBER
007	1	SPARE NUMBER
008	1	SPARE NUMBER
009	1	SPARE NUMBER
010	1	SOILED DISHTABLE ASSEMBLY
011	1	DISHWASHER WITH BOOSTER HEATER (VENTLESS)
012	1	CLEAN DISHTABLE WITH POT WASHING SINKS
013	1	WALL SHELVING
014	1	UTENSIL RACK WITH SHELF
015	2	MOBILE POT SHELVING
016	1	SPARE NUMBER
017	1	SPARE NUMBER
018	1	SPARE NUMBER
019	1	SPARE NUMBER
020	1	HAND SINK WITH SOAP AND TOWEL DISPENSER
021	1	EYE WASH STATION
022	1	WORKTABLE WITH SINK
023	2	WALL SHELVING
024	1	MOBILE WORTABLE
025	1	WORKTABLE WITH SINKS AND DRAWER
026	3	WALL SHELVING
027	1	ICE BIN (365 LBS.)
028	1	ICE MAKER (310 LBS.)
029	1	WATER FILTER
030	1	WORKTABLE WITH MAPLE TOP
031	3	MOBILE INGREDIENT BINS
032	1	WALL SHELVING
033	1	MOBILE REACH-IN REFRIGERATOR
034	1	EXHAUST HOOD WITH MAKE-UP AIR (TYPE 1)
035	1	STAINLESS STEEL WALL FLASHING
036	1	CONVECTION OVEN WITH STAND (EXISTING/ RELOCATE)

037	1	(4) OB RANGE WITH GRIDDLE AND OVEN
038	1	SPARE NUMBER
039	1	SPARE NUMBER
040	1	CHEF'S COUNTER
041	1	REFRIGERATED HOT/COLD PANS (DROP-IN)
042	1	MOBILE REFRIGERATED WORKTABLE
043	1	STAINLESS STEEL PASS SHELF
044	2	HEAT LAMP
045	1	FIRE SUPPRESSION SYSTEM
046	1	EXHAUST HOOD CONTROL CABINET
047	1	EXHAUST HOOD TEMP. SENSOR AND LIGHT/ FAN SWITCH
048	1	SPARE NUMBER
049	1	SPARE NUMBER
050	1	HOT FOOD WELLS (DROP-IN)
051	1	REFRIGERATED COLD PAN (DROP-IN)
052	1	FOOD SHIELD WITH DISPLAY LIGHTS
053	1	CHILLED WATER DISPENSER WITH DRIP TROUGH
054	1	TEA DISPENSER
055	2	COFFEE AIRPOTS
056	1	COFFEE MAKER
057	1	ICED TEA BREWER
058	1	MOBILE UNDERCOUNTER REFRIGERATOR
059	1	SPARE NUMBER
060	1	REFRIGERATION RACK
061	1	SPARE NUMBER

4.4 FOODSERVICE EQUIPMENT ITEMIZED

ITEM 001: WALK-IN COOLER/FREEZER ASSEMBLY
Quantity: One (1)
Manufacturer: American Panel Corporation
Model: Custom

1. Refrigerator shall be manufactured in accordance with requirements as specified in Paragraph 2.8, Cold Storage Rooms (Type I Floor at Freezer).
2. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to consist of one (1) room at -10°F to -5° F.
 - b. Light fixture shall be LED. Light fixtures to be as shown on electrical plan.
 - c. Stainless steel paneling shall be full height to ceiling on exposed exterior including closure panels.

- d. Interior ceiling height shall be approximately 8'-0" clear, interior ceiling panels to have smooth white baked enamel finish. Field-verify actual clearance from floor to overhead interferences.
- e. Interior walls shall be stucco embossed aluminum.
- f. Provide strip curtain, clear, 8" wide with 2" overlap.
- g. Units equipped with temperature alarm and dry contactors for building monitoring system.
- h. Provide model 200 control panel with external alarm.

ITEM 002: MOBILE COOLER SHELVING
Quantity: Four (4)
Manufacturer: Metro
Model: METROMAX Q

- 1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Shelving shall be sized as indicated on the plan.
 - b. Section shall consist of four (4) posts and four (4) shelves.
 - c. Posts shall be MQ63UPE.
 - d. Bottom shelf shall be set 10" above finish floor line and the three (3) remaining shelves equally spaced.
 - e. Provide two (2) Model 5PCXM and two (2) Model 5PCBXM casters per unit.

ITEM 003: UNIT COOLER (COOLER)
Quantity: One (1)
Manufacturer: OMNI
Model: KLP107MA-S1D

- 1. Unit included as part of Item 060, Refrigeration Rack.

ITEM 004: MOBILE FREEZER SHELVING
Quantity: Three (3)
Manufacturer: Metro
Model: METROMAX Q

- 1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Shelving shall be sized as indicated on the plan.
 - b. Section shall consist of four (4) posts and four (4) shelves.
 - c. Posts shall be MQ63UPE.
 - d. Bottom shelf shall be set 10" above finish floor line and the three (3) remaining shelves equally spaced.
 - e. Provide two (2) Model 5PCXM and two (2) Model 5PCBXM casters per unit.

ITEM 005: UNIT COOLER (FREEZER)
Quantity: One (1)
Manufacturer: OMNI
Model: KLP105LE-S2D

- 1. Unit included as part of Item 060, Refrigeration Rack.

ITEM 006: SPARE NUMBER

ITEM 007: SPARE NUMBER

ITEM 008: SPARE NUMBER

ITEM 009: SPARE NUMBER

ITEM 010: SOILED DISHTABLE ASSEMBLY

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawing and as follows:
 - a. Dishtable shall be "L" shaped and sized as detailed on the drawings approximately 5'-9" x 7'-0" long x 3'-1" high to include: one (1) 1'-8" x 2'-0" x 7" deep pre-rinse sink, with removable rack guide with one (1) Pre-Rinse Faucet T&S Brass Model Number B-2278-A12CRCELMOD, and one (1) Type 1 Drain
 - b. Dishtable to accommodate Item 011, Dishwasher with Booster Heater (Ventless).
 - c. Provide cutout to accommodate one (1) Component Hardware Model J92-5000 Scrap block located as shown on drawings with space below for Trash Receptacle by Owner/ Operator.
 - d. Provide back splash as shown on drawings.
 - e. See Elevations "A", "B" and "C" Sheet FS-6 for additional information.
 - f. See Standard Details C-1-1 (G), C-1-1A (2), C-8-1, C-8-2 and C-8-10.

ITEM 011: DISHWASHER WITH BOOSTER HEATER (VENTLESS)

Quantity: One (1)

Manufacturer: Hobart

Model: AM15VLT-2

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Dishwasher shall be corner operation, extended chamber height.
 - b. Single point electrical connection.
 - c. Provide 70° F rise built in electric booster heater.
 - d. Cold water drain tempering kit.
 - e. Door interlock switch.
 - f. Provide additional Flat Rack and Peg Rack.
 - g. 208 Volt, 3-Phase.

ITEM 012: CLEAN DISHTABLE WITH POT WASHING SINKS

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Dishtable shall be shaped and sized as detailed on the drawings approximately 10'-10" x 2'-6" x 3'-1" high to include: three (3) 2'-0" x 2'-0" x 1'-2" deep wash, rinse and sanitize sinks with two (2) Faucets T&S Brass Model Number B-2358MOD and three (3) Type 7 Drains.
 - b. Dishtable to accommodate Item 011, Dishwasher with Booster Heater (Ventless).
 - c. Provide back and left side splashes as shown on drawings.
 - d. Bottom shelf below left side drainboard as shown on drawings.
 - e. See Elevations "A" and "B" Sheet FS-6 for additional information.
 - f. See Standard Details C-1-1 (G), C-1-1A (2), C-7-1, C-8-1 and C-8-5.

ITEM 013: WALL SHELVING

Quantity: One (1)

Manufacturer: Metro

Model: SMARTWALL G3

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide one (1) model 1448BR Super Erecta Shelf.
 - b. Provide four (4) Shelf Collar Plug (Hole Plug).
 - c. Provide one (1) model SW56BR SmartWall G3 Wall Track.
 - d. Provide two (2) model SWU15BR SmartWall G3 Upright.
 - e. Provide two (2) model SWS14BR SmartWall G3 Shelf Support.
 - f. Provide one (1) model WG1848BR SmartWall G3 Wire Grid.
 - g. Secure grid to wall with factory approved fasteners. Provide wall backing.

ITEM 014: UTENSIL RACK WITH SHELF
Quantity: One (1)
Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Rack shelf shall be of shaped and sized as detailed on the drawings approximately 6'-0" mounted at +6'-6" AFF.
 - b. See Elevation "A" Sheet FS-6 for additional information.
 - c. See Standard Detail C-7-4A (Type "1").

ITEM 015: MOBILE POT SHELVING
Quantity: Two (2)
Manufacturer: Metro
Model: METROMAX Q

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Shelving shall be sized as indicated on the plan.
 - b. Section shall consist of four (4) posts and four (4) shelves.
 - c. Posts shall be MQ74UPE.
 - d. Bottom shelf shall be set 10" above finish floor line and the three (3) remaining shelves equally spaced.
 - e. Provide two (2) Model 5MPXGSA, and two (2) Model 5MPBXGSA, casters per unit.

ITEM 016: SPARE NUMBER

ITEM 017: SPARE NUMBER

ITEM 018: SPARE NUMBER

ITEM 019: SPARE NUMBER

ITEM 020: HAND SINK WITH SOAP AND TOWEL DISPENSER
Quantity: One (1)
Manufacturer: Advance Tabco
Model: 7-PS-87

1. Unit to be complete with all standard components and/or accessories and as follows:
 - a. Provide with Model Number K-08 Low Flow Aerator.

ITEM 021: EYE WASH STATION
Quantity: One (1)
Manufacturer: T&S Brass
Model: EW-7360B

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Line Strainer.

ITEM 022: WORKTABLE WITH SINK

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Worktable shall be shaped and sized as detailed on the drawings approximately 6'-0" x 2'-6" x 3'-0" high to include: one (1) 1'-8" x 2'-0" x 1'-2" deep sink with one (1) Faucet T&S Brass Model Number B-0231-CR-KITMOD and one (1) Type 1 Drain.
 - b. Provide back splash as shown on drawings.
 - c. Provide bottom shelf below as shown on drawings.
 - d. See Elevation "D" Sheet FS-6 for additional information.
 - e. See Standard Details C-1-1 (C), C-1-1A (2) and C-7-1.

ITEM 023: WALL SHELIVING

Quantity: Two (2)

Manufacturer: Metro

Model: SMARTWALL G3

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide one (4) model 1436BR Super Erecta Shelf.
 - b. Provide four (16) Shelf Collar Plug (Hole Plug).
 - c. Provide one (2) model SW40BR SmartWall G3 Wall Track.
 - d. Provide two (4) model SWU30BR SmartWall G3 Upright.
 - e. Provide two (8) model SWS14BR SmartWall G3 Shelf Support.
 - f. Provide one (2) model WG1836BR SmartWall G3 Wire Grid.
 - g. Provide five (10) model HK23C Smartwall G3 Snap-On Hook.
 - h. Provide two (2) model H210C Smartwall G3 Storage Basket.
 - i. Secure grid to wall with factory approved fasteners. Provide wall backing.

ITEM 024: MOBILE WORTABLE

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Worktable shall be shaped and sized as detailed on drawings approximately 6'-0" x 2'-6" x 3'-0 high.
 - b. Full length bottom shelf below as shown on drawings.
 - c. Provide set of six (6) casters, two (2) with brakes.
 - d. See Standard Details C-1-1 (C) and C-7-1.

ITEM 025: WORKTABLE WITH SINKS AND DRAWER

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Worktable shall be "L" shaped and sized as detailed on the drawings approximately 10'-9" x 4'-8" long x 2'-6" wide x 3'-0" high to include: two (2) 2'-0" x 2'-0" x 1'-0" deep sink with one (1) Faucet T&S Brass Model Number B-0231-CR-

- KITMOD and two (2) Type 1 Drains as shown.
- b. Provide utility drawer located on left side end as shown on drawings
- c. Provide back splash as shown on drawings
- d. Provide bottom shelf below left side as shown.
- e. See Elevation "E" Sheet FS-6 for additional information.
- f. See Standard Details C-1-1 (C), C-1-1 (D), C-1-1A (2), C-1-3, C-7-1 and C-8-7.

ITEM 026: WALL SHELVING
Quantity: Three (3)
Manufacturer: Metro
Model: SMARTWALL G3

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide three (3) model 1442BR Super Erecta Shelf.
 - b. Provide twenty-four (24) model 9997C Shelf Collar Plug (Hole Plug).
 - c. Provide three (3) model SW56BR SmartWall G3 Wall Track.
 - d. Provide six (6) model SWU30BR SmartWall G3 Upright.
 - e. Provide twelve (12) model SWS14BR SmartWall G3 Shelf Support.
 - f. Provide three (3) model WG1848BR SmartWall G3 Wire Grid.
 - g. Provide fifteen (15) model HK23C Smartwall G3 Snap-On Hook.
 - h. Provide six (6) model H210C Smartwall G3 Storage Basket.
 - i. Secure grid to wall with factory approved fasteners. Provide wall backing.

ITEM 027: ICE BIN (365 LBS.)
Quantity: One (1)
Manufacturer: Manitowoc
Model: D400

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide 6" high stainless steel adjustable legs.

ITEM 028: ICE MAKER (310 LBS.)
Quantity: One (1)
Manufacturer: Manitowoc
Model: IYT0300A

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be air-cooled.
 - b. Production capacity per 24 hours shall be 310 pounds at an air temperature of 70° F and a water temperature of 50° F.
 - c. Cube size shall be half-dice.
 - d. Provide unit with automatic cleaning system.

ITEM 029: WATER FILTER
Quantity: One (1)
Manufacturer: OptiPure
Model: QTI-1

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide two (2) additional replacement filter cartridges.

ITEM 030: WORKTABLE WITH MAPLE TOP

Quantity: One (1)
Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Worktable shall be shaped and sized as detailed on the drawings approximately 5'-6" x 2'-6" x 3'-0" high, including 1 3/4" thick hard rock maple top.
 - b. Stainless steel flour trough at front.
 - c. Clear opening below to accommodate Item 031, Mobile Ingredient Bins.
 - d. Provide back splash as shown on drawings.
 - e. See Elevation "E" Sheet FS-6 for additional information.
 - f. See Standard Details C-1-1 (C), C-1-1A (2), C-7-1 and C-7-2.

ITEM 031: MOBILE INGREDIENT BINS
Quantity: Three (3)
Manufacturer: Cambro
Model: IBSF27148

1. Unit to be complete with all standard components and/or accessories.

ITEM 032: WALL SHELVING
Quantity: One (1)
Manufacturer: Metro
Model: SMARTWALL G3

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide two (2) model 1460BR Super Erecta Shelf.
 - b. Provide eight (8) model 9997C Shelf Collar Plug (Hole Plug)..
 - c. Provide one (1) model SW72BR SmartWall G3 Wall Track.
 - d. Provide two (2) model SWU30BR SmartWall G3 Upright.
 - e. Provide four (4) model SWS14BR SmartWall G3 Shelf Support.
 - f. Provide one (1) model WG1860BR SmartWall G3 Wire Grid.
 - g. Provide ten (10) model HK23C Smartwall G3 Snap-On Hook.
 - h. Provide four (4) model H210C Smartwall G3 Storage Basket.
 - i. Secure grid to wall with factory approved fasteners. Provide wall backing.

ITEM 033: MOBILE REACH-IN REFRIGERATOR
Quantity: One (1)
Manufacturer: True Manufacturing Co., Inc.
Model: STR2R-2S-HC

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Refrigerator shall have doors hinged as indicated on the drawings, provide with factory installed lock.
 - b. Cord and plug set.
 - c. Provide exterior digital thermometer.
 - d. Provide four (4) additional wire shelves.
 - e. Set of four (4) casters, two (2) with brakes.
 - f. Five (5) year extended compressor warranty and two (2) year labor warranty.

ITEM 034: EXHAUST HOOD WITH MAKE-UP AIR (TYPE 1)
Quantity: One (1)
Manufacturer: Streivor Air System
Model: WCBD

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Overall length as shown on the Drawing.
 - b. Ventilation section shall be high velocity type grease extractor with an air inlet opening above and parallel to the cooking surface. Ventilator to utilize full-length horizontal baffles for centrifugal grease extraction.
 - c. Stainless steel construction, not less than 18-gauge, Type 304. All exposed surfaces shall be a Number 4 finish, including closure panels to finished ceiling as required.
 - d. Ventilator to be factory pre-plumbed and pre-wired.
 - e. Approvals to include U.L. listed under the category "Grease Extractors for Exhaust Ducts", and listed or recognized by BOCA, ICBO (refer to Research Report 2064), NSF (in Canada, ULS and CSA) and in accordance with all recommendations of NFPA's Standard No. 96.
 - f. Electrical: 120/60/1.
 - g. Provide three (3) LED light fixtures, installed and pre-wired.
 - h. Duct connection sizes, exhaust and supply CFM and static pressures shall be as indicated on Equipment Schedule and drawings and shall not exceed the same. (Maximum cooking surface temperature 700o F.)
 - i. Ventilator to be pre-piped with all components required for "Ansul" Fire Suppression System, Item 045.
 - j. Automatic fan interlock as per local code.
 - k. Provide thermostat components as required to accommodate Auto Start Fan Control. Fan control panel by mechanical division. Coordinate as required.
 - l. After installation and hook-up, the Kitchen Equipment Contractor shall verify air volumes at each exhaust and air make-up air duct. A written report shall be submitted to the Owner of all readings. All incorrect air volumes shall be reported to the General Contractor for adjustments to be by the Mechanical Contractor. Incorrect air volumes shall be rechecked after adjustments.
 - m. See Manufacturer's Engineered Drawing, "FSV-1" and "FSV-2" for additional details.

ITEM 035: STAINLESS STEEL WALL FLASHING
Quantity: One (1)
Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Flashing to run full length of wall at Exhaust Hood Item 34, from top of cove base tile to underside of exhaust hood.
 - b. See Elevation "F" Sheet FS-6 for additional information.
 - c. See Standard Detail C-2-11.

ITEM 036: CONVECTION OVEN WITH STAND (EXISTING/RELOCATE)
Quantity: One (1)
Manufacturer: Southbend
Model: SLGS/12SC

1. Existing item of equipment to be removed and reinstalled by the KEC located as shown on the drawings or as directed by the Owner. Verify all existing Utility requirements and conditions as needed.

ITEM 037: MOBILE (4) OB RANGE WITH GRIDDLE AND OVEN
Quantity: One (1)
Manufacturer: Garland/US Range
Model: G60-4G36RS

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit with oven bases, provide one (1) additional oven rack each oven.
 - b. 36" griddle section at right side.
 - c. 22.5" stainless steel back guard.
 - d. Provide set of four (4) casters, two (2) with brakes.
 - e. 3/4" rear gas connection with pressure regulator, quick disconnect, restraining device and Safety-Sets as specified in Section 2.2, H of the Specific Conditions.

ITEM 038: SPARE NUMBER

ITEM 039: SPARE NUMBER

ITEM 040: CHEF'S COUNTER

Quantity: One (1)

Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Counter shall be shaped and sized as detailed on the drawings approximately 10'-4" x 3'-2" wide x 3'-0" high.
 - b. Cutout to accommodate Item 041, Refrigerated Hot/Cold Pans (Drop-In).
 - c. Counter notched to accommodate Item 042, Mobile Refrigerated Worktable.
 - d. Provide back splash as shown on drawings.
 - e. Open and intermediate shelves below as shown on drawings.
 - f. See Elevation "G" Sheet FS-6 for additional information.
 - g. See Standard Detail C-1-1 (C), C-1-1A (2) and C-2-1.

ITEM 041: REFRIGERATED HOT/COLD PANS (DROP-IN)

Quantity: One (1)

Manufacturer: Wells

Model: HRCP-7300

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be installed as shown in Item 040, Chef's Counter.
 - b. Drain shall have quick opening type drain valve with piping extending to floor sink.
 - c. Provide extension control panel wiring if required for control mounting location.

ITEM 042: MOBILE REFRIGERATED WORKTABLE

Quantity: One (1)

Manufacturer: True

Model: TFP-48-18M-D-4

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Refrigerator shall have drawers as indicated on the drawings, provide with factory installed locks.
 - b. Cord and plug set.
 - c. Provide with Brown Richlite Cutting Board.
 - d. Cord and plug set.
 - e. Provide set of four (4) casters, two (2) with brakes.
 - f. Five (5) year extended compressor warranty and two (2) year parts and labor warranty.

ITEM 043: STAINLESS STEEL PASS SHELF

Quantity: One (1)
Manufacturer: Custom Fabricate

1. Fabricate in accordance with the General and Specific Conditions of these Specifications, as shown on the drawings and as follows:
 - a. Pass Shelf shall be shaped and sized as detailed on the drawings approximately 7'-0" long x 1'-8" wide mounted on low wall.
 - b. Provide stainless steel closures below.
 - c. See Elevations "G" and "H" Sheet FS-6 for additional information.
 - d. See Standard Detail C-1-1 (C).

ITEM 044: HEAT LAMP
Quantity: Two (2)
Manufacturer: Hatco
Model: DL-700

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Lower switch on retractable/ adjustable cord.
 - b. 250W, Red coated bulbs.
 - c. Powder coated housing.
 - d. Confirm shade style, color and cord color with Interior Designer.

ITEM 045: FIRE SUPPRESSION SYSTEM
Quantity: One (1)
Manufacturer: Ansul Fire Protection
Model: R-102 WET

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to meet UL Test Standards 300, NFPA Standards 17A and 96, and be a U.L. listed automatic wet chemical fire suppression system to provide protection for plenum and/or exhaust ducts and all grease-producing cooking surfaces located under canopy hood.
 - b. All piping, conduit, cable, etc. shall be concealed as applicable. All nozzles and exposed piping to be chrome-plated or stainless steel.
 - c. Size, number and location of nozzles, number of fusible links to be in accordance with U.L. limits for this particular system.
 - d. Manual control of the system shall be possible by actuation of remote release control (s).
 - e. Double-pole, double-throw, electric (snap action) switch assembly.
 - f. Cylinder (s) shall be rack mounted to wall in a stainless steel enclosure.
 - g. Electrical/shunt-trip contactors required will be furnished and installed by the Electrical Contractor for actuation by the Ansul control devices.
 - h. Obtain permits and conduct test of system in the presence of the Contracting Officer and the agency having jurisdiction.

ITEM 046: EXHAUST HOOD CONTROL CABINET
Quantity: One (1)
Manufacturer: Streivor Air System
Model: -

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be included as part of Item 034, Exhaust Hood with Make-Up Air (Type 1).
 - b. See Manufacturer's Engineered Drawing "FSV-1" thru "FSV-2" for additional

details.

ITEM 047: EXHAUST HOOD TEMP. SENSOR AND LIGHT/ FAN SWITCH
Quantity: One (1)
Manufacturer: Streivor Air System
Model: -

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be included as part of Item 046, Exhaust Hood Control Cabinet and interconnected with Item 034, Exhaust Hood with Make-Up Air (Type 1).
 - b. See Manufacturer's Engineered Drawing "FSV-1" thru "FSV-2" for additional details.

ITEM 048: SPARE NUMBER

ITEM 049: SPARE NUMBER

ITEM 050: HOT FOOD WELLS (DROP-IN)
Quantity: One (1)
Manufacturer: Wells
Model: MOD-300TDM

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be installed as shown in Millwork Serving Counter as shown on drawings, coordinate with Millwork Fabricator.
 - b. Drain shall have quick opening type drain valve with piping extending to floor sink.
 - c. Provide extension control panel wiring if required for control mounting location.
 - d. Kitchen Equipment Contractor to coordinate with Millwork Fabricator regarding Equipment Items to be incorporated within Millwork Counters. Kitchen Equipment Contractor shall schedule and coordinate his work with that of the other trades to expedite the job progress.

ITEM 051: REFRIGERATED COLD PAN (DROP-IN)
Quantity: One (1)
Manufacturer: Wells
Model: RCP-400

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Unit to be installed as shown in Millwork Serving Counter as shown on drawings, coordinate with Millwork Fabricator.
 - b. Five (5) year extended compressor warranty and one (1) year parts and labor warranty.
 - c. Kitchen Equipment Contractor to coordinate with Millwork Fabricator regarding Equipment Items to be incorporated within Millwork Counters. Kitchen Equipment Contractor shall schedule and coordinate his work with that of the other trades to expedite the job progress

ITEM 052: FOOD SHIELD WITH DISPLAY LIGHTS
Quantity: One (1)
Manufacturer: BSI
Model: ZG9930

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Shaped and sized as detailed on drawings approximately 9'-7" long, to be mounted on Millwork Counter.
 - b. Self-service.
 - c. Frame and posts to be 1" round tubing.
 - d. Tempered horizontal flat mount glass at front, top shelf and end panels.
 - e. KEC is responsible for insuring food shield assembly is coordinated with serving counter with regard to local health code compliance maintaining maximum allowable access clearance and reach to self-service equipment.
 - f. LED display (length as required) with remote ballast and switches mounted in Counter. Confirm LED color with lighting consultant.
 - g. Verify installation requirements with Interior Designer for mounting through solid surface countertop.
 - h. Verify finish with Interior Designer.
 - i. Kitchen Equipment Contractor to coordinate with Millwork Fabricator regarding Equipment Items to be incorporated within Millwork Counters. Kitchen Equipment Contractor shall schedule and coordinate his work with that of the other trades to expedite the job progress.
 - j. See Elevation "H" Sheet FS-6 for additional information.

ITEM 053: CHILLED WATER DISPENSER WITH DRIP TROUGH
Quantity: One (1)
Manufacturer: Crysalli
Model: CBR-V1C

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide with RDP-1SSQ-2CL recessed drain pan.
 - b. Provide with CR-UCM1 chiller mounted in cabinet below.
 - c. Provide with CR-KT-UCM install kit.
 - d. Provide with CR-24FC water filter system.

ITEM 054: TEA DISPENSER
Quantity: One (1)
Manufacturer: BUNN
Model: 34100.0002

1. Unit to be complete with all standard components and/or accessories.

ITEM 055: COFFEE AIRPOTS
Quantity: Two (2)
Manufacturer: BUNN
Model: 13041.0001

1. Unit to be complete with all standard components and/or accessories.

ITEM 056: COFFEE MAKER
Quantity: One (1)
Manufacturer: BUNN
Model: CWFT-TWIN-APS

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Provide in line water filter with two (2) additional cartridges.

ITEM 057: ICED TEA BREWER
Quantity: One (1)
Manufacturer: BUNN
Model: 41400.0000

1. Unit to be complete with all standard components and/or accessories.

ITEM 058: MOBILE UNDERCOUNTER REFRIGERATOR
Quantity: One (1)
Manufacturer: True
Model: TUC-27-ADA-HC

1. Unit to be complete with all standard components and/or accessories including the following:
 - a. Refrigerator shall have door hinged as indicated on the drawings, provide with factory installed locks.
 - b. Cord and plug set.
 - c. Provide exterior digital thermometer.
 - d. Provide one (1) additional wire shelf.
 - e. Provide set of four (4) 2 ½" casters, two (2) with brakes.
 - f. Five (5) year extended compressor warranty and two (2) year labor warranty.

ITEM 059: SPARE NUMBER

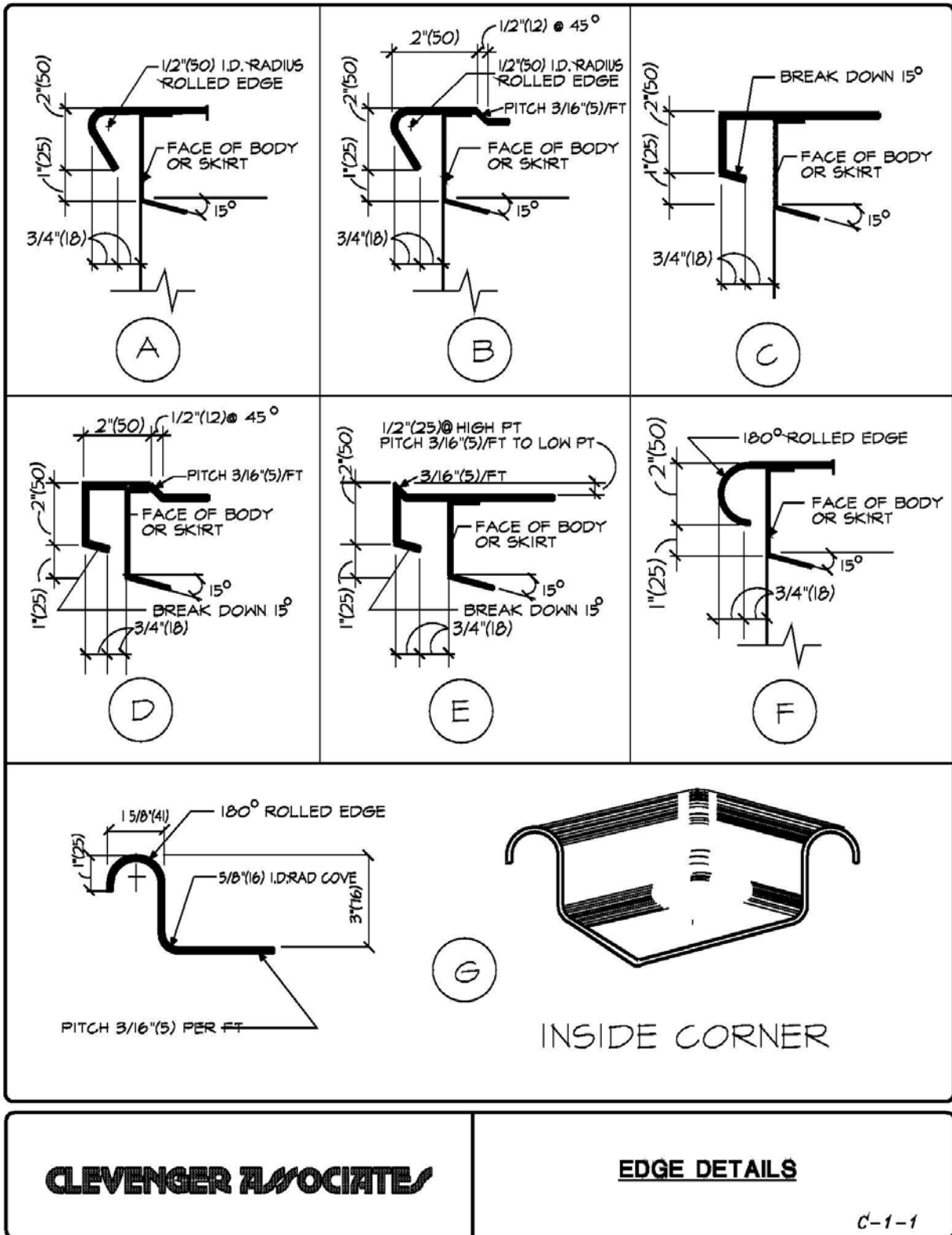
ITEM 060: REFRIGERATION RACK
Quantity: One (1)
Manufacturer: OMNI
Model: OTA1-AC-H-2-0-3-4

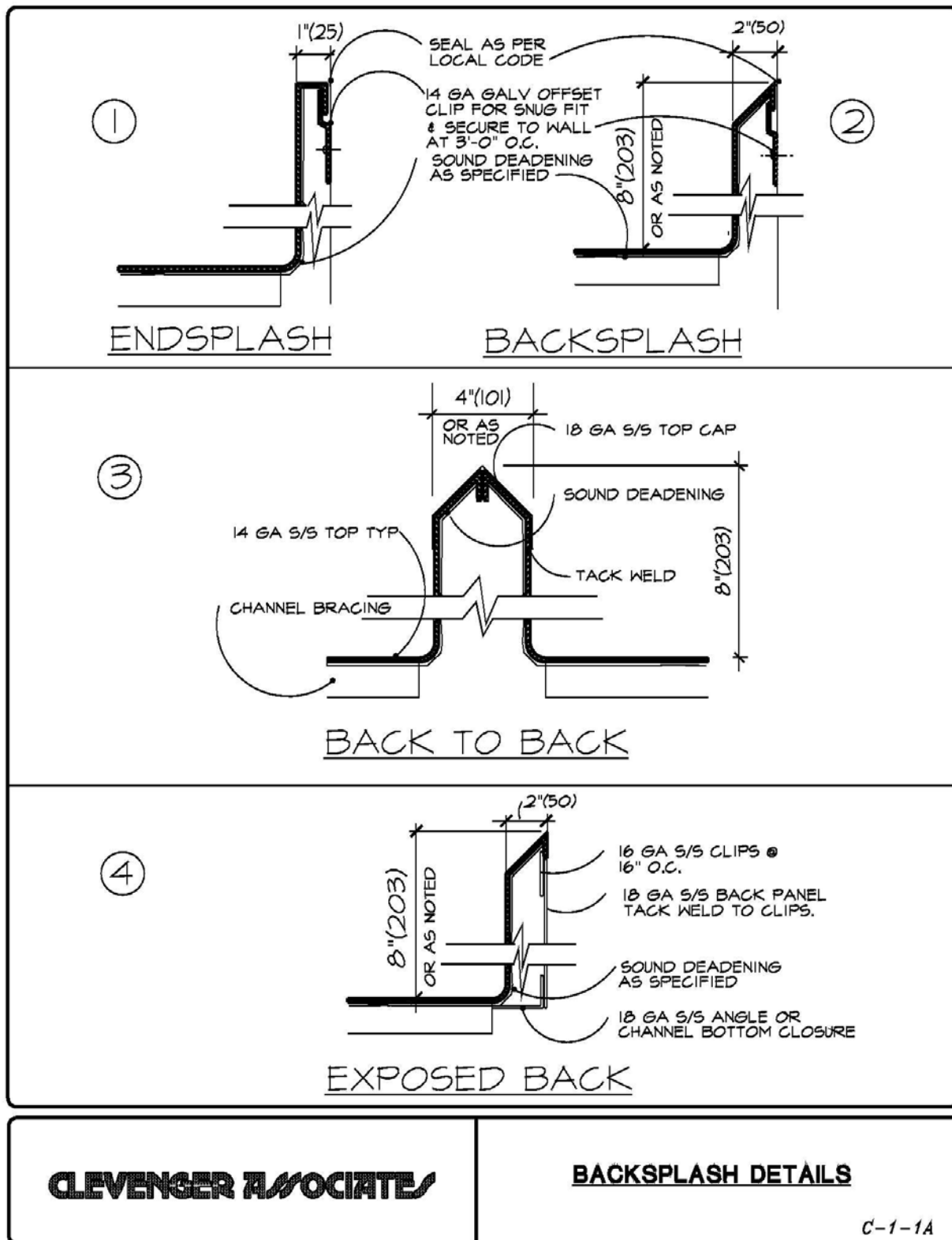
1. Refrigeration system shall be installed as shown on the drawings and shall include all components as specified in applicable subparagraphs of Paragraph 2.9, of the Specific Conditions.
2. Unit to be complete with all standard components and/or accessories including the following:
 - a. Refrigeration system shall be Outdoor air-cooled, located as shown on drawings. Verify all requirements and conditions as needed.
 - b. Unit cooler assembly shall be sized to balance with the condensing unit. They shall be made of plate type aluminum fins with copper tubes. Fan motors and coil to be housed in a heavy gauge aluminum enclosure. Unit cooler to have drain pan with suitable drainpipe fitting refrigerator. Unit Cooler (Cooler), to be air defrost, Unit Cooler (Freezer), to be electric defrost.
 - c. Installation shall include all piping, fittings, controls and accessories as required for a complete operational installation. Drain line from evaporators to floor sink shall be a part of this installation. All penetrations through roof, ceiling and walls for piping and other utility penetrations shall be fully sealed and vapor-proofed.
 - d. Provide one (1) year parts and labor warranty and extended four (4) year compressor warranty.
 - e. Field-verify routing of refrigeration line runs.
 - f. See Manufactured Engineered Drawing Sheets "FSR-1" and "FSR-2" for additional details and information.

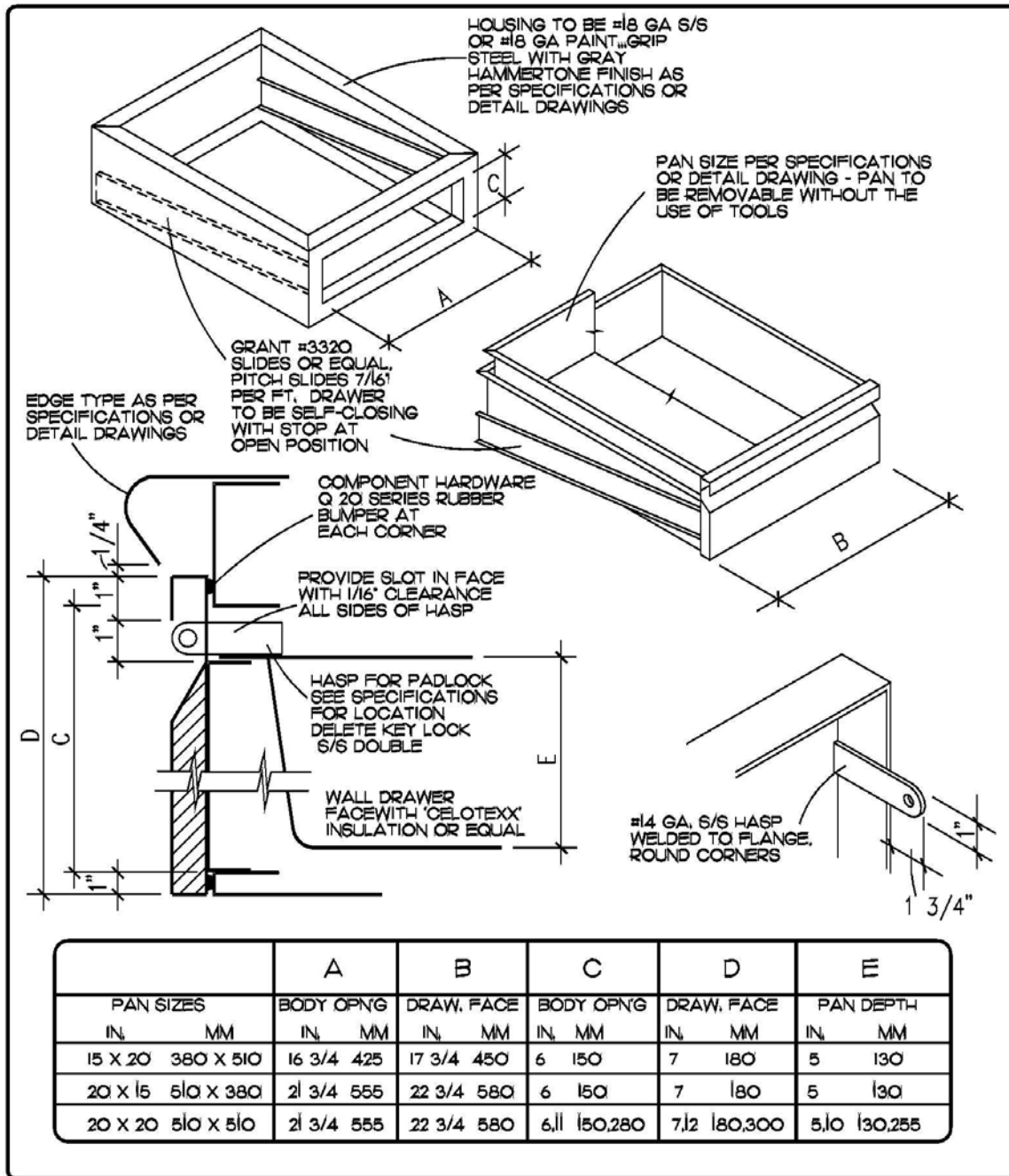
ITEM 061: SPARE NUMBER

4.5 FOODSERVICE STANDARD DETAILS

C-1-1		EDGE DETAILS
C-1-1A		BACKSPLASH DETAILS
C-1-3		DRAWER DETAIL – REMOVABLE PAN TYPE
C-2-1		SEMI-ENCLOSED COUNTER
C-2-11		FLASHING DETAIL
C-7-1		OPEN BASE TABLE
C-7-2		WOOD TABLE DETAIL
C-7-4A		WALL MOUNTED POT AND PAN RACK
C-8-1		CLEAN DISHTABLE AND DRAINBOARD
C-8-2		SOILED DISHTABLE ASSEMBLY
C-8-5		SINK ASSEMBLY/DISHTABLE SINK
C-8-7		MARINE EDGE SINK
C-8-10		PRE-RINSE SINK WITH REMOVABLE RACK GUIDE



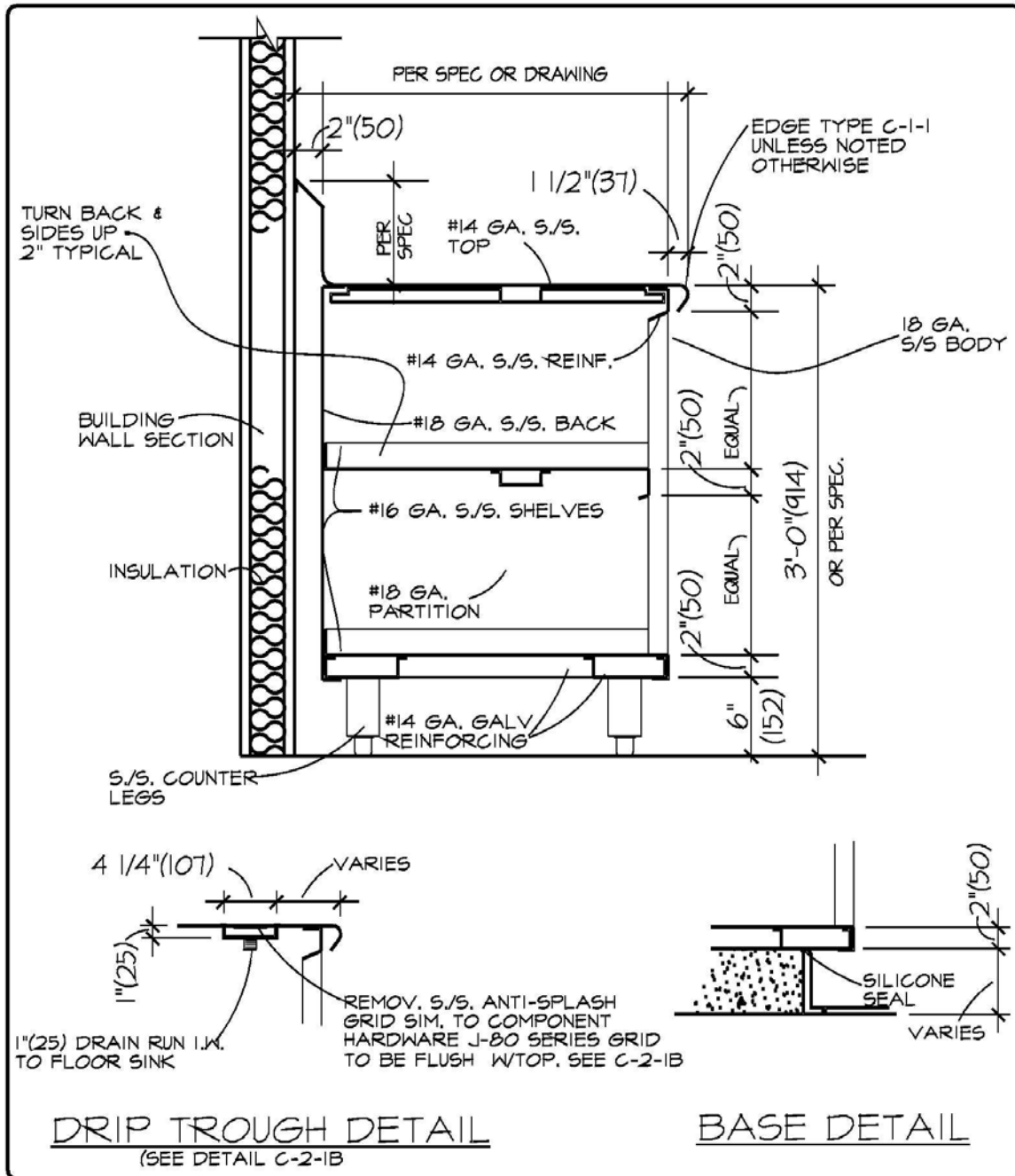




CLEVENGER ASSOCIATES

DRAWER DETAIL -
REMOVABLE PAN TYPE

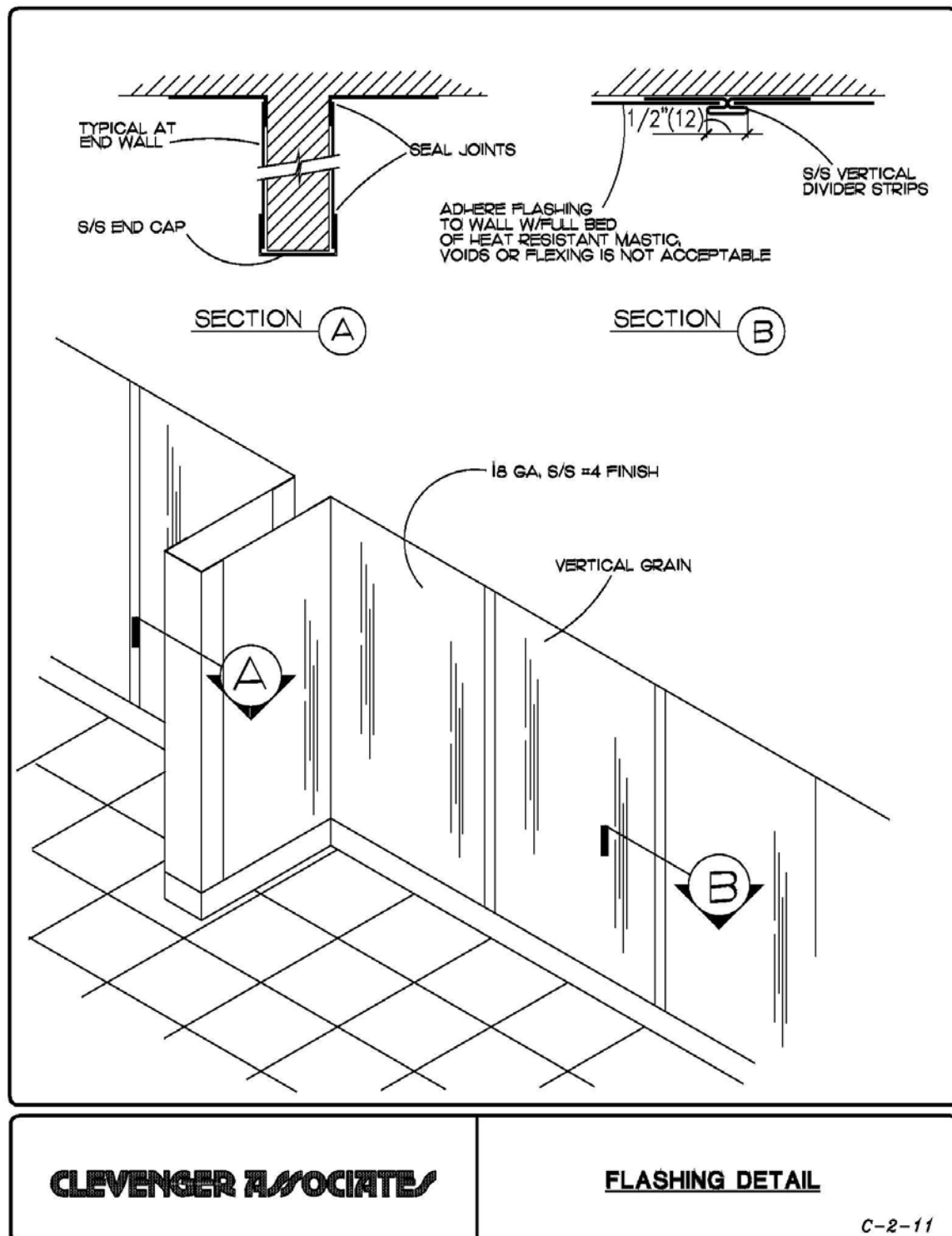
C-1-3

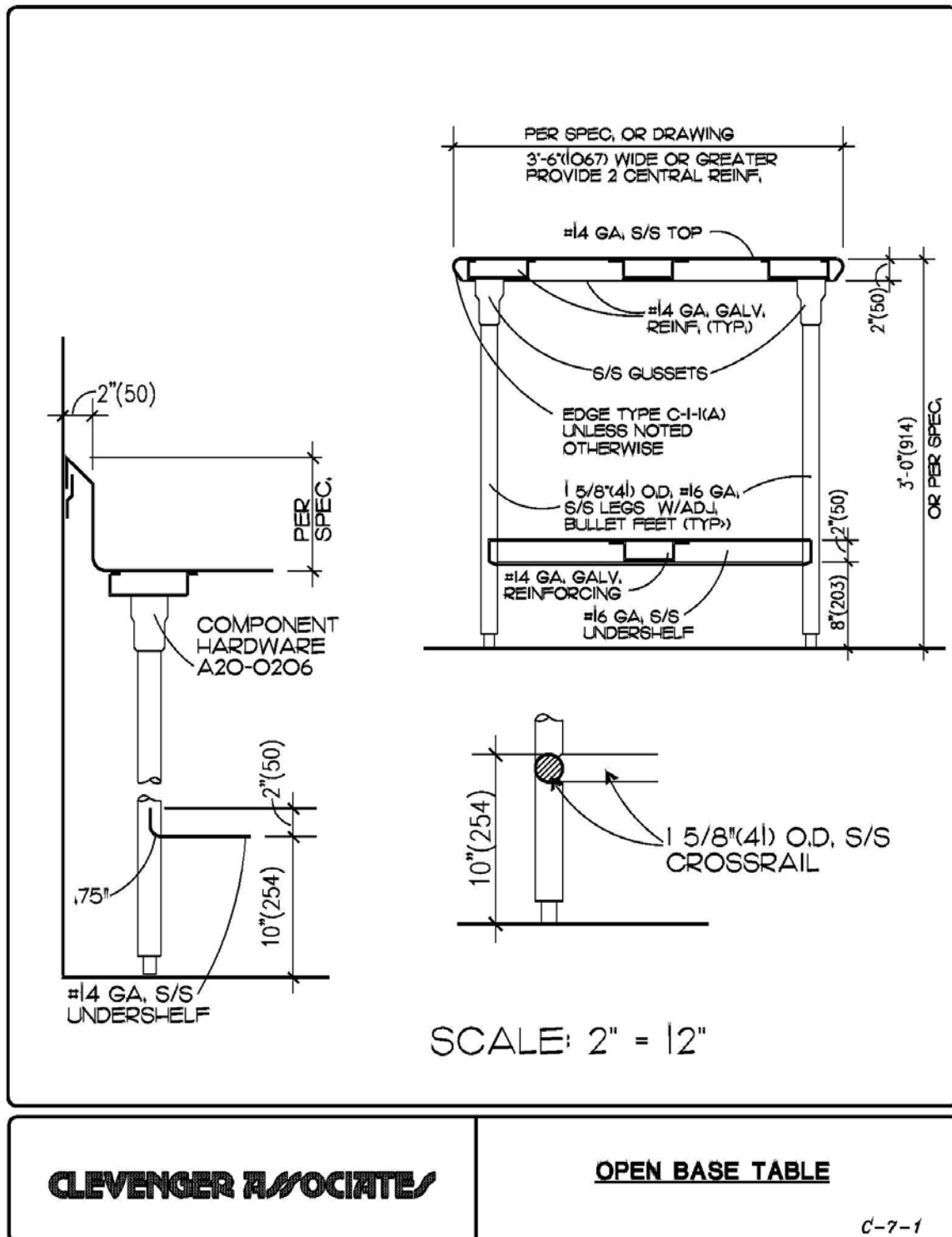


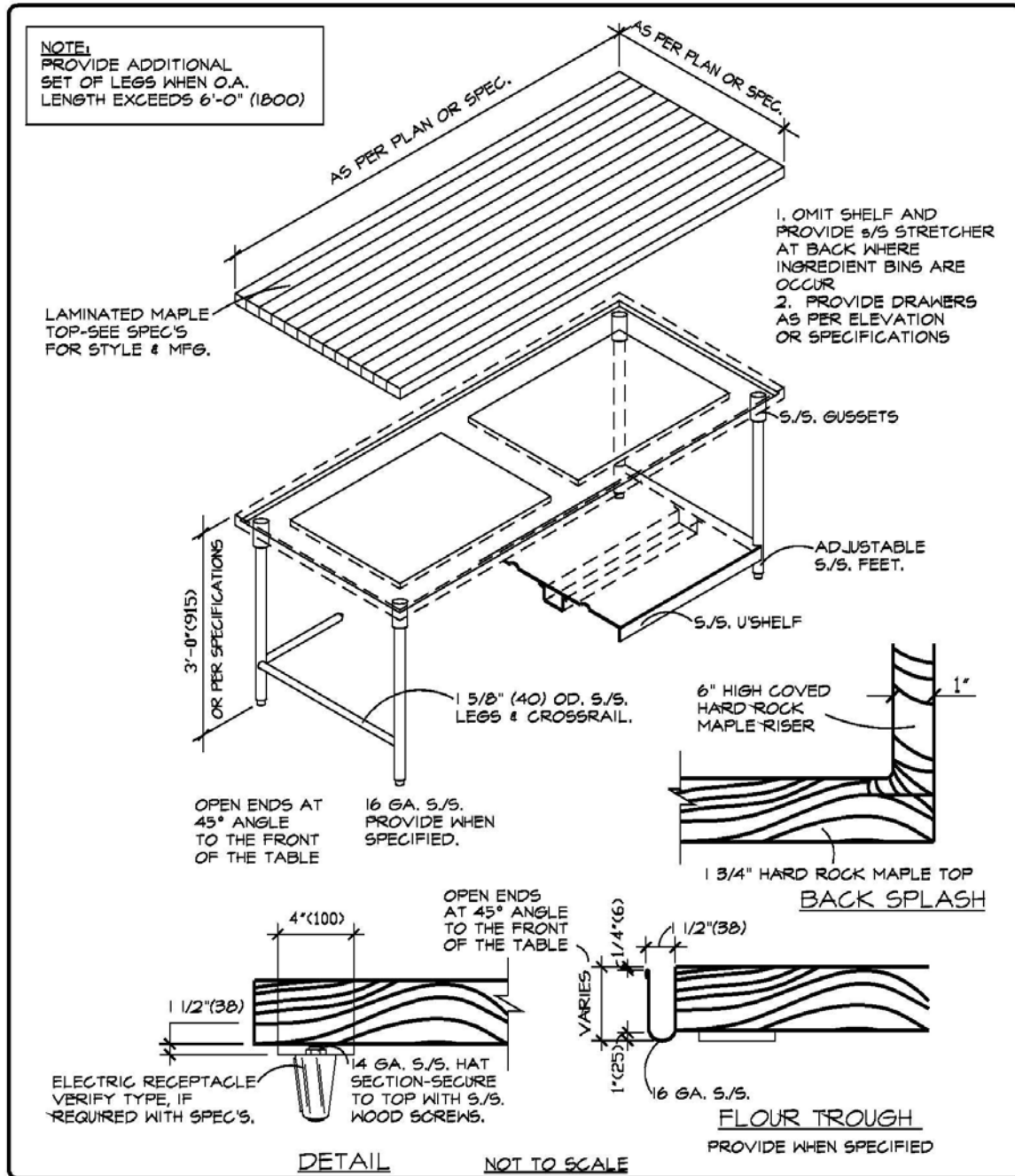
CLEVENGER ASSOCIATES

**SEMI-ENCLOSED
 COUNTER**

C-2-1



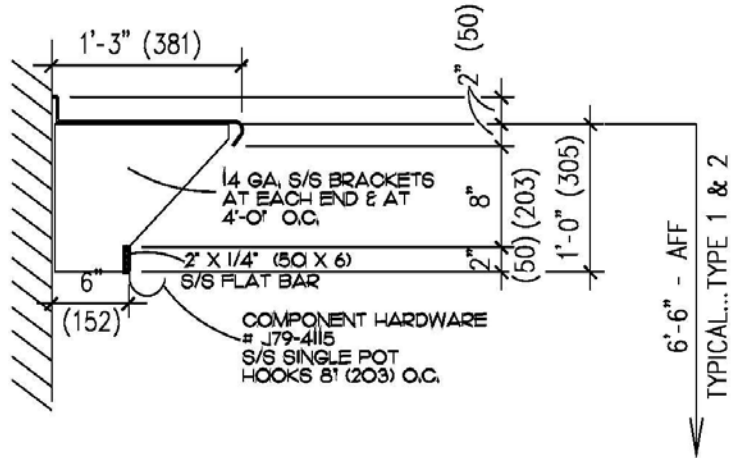




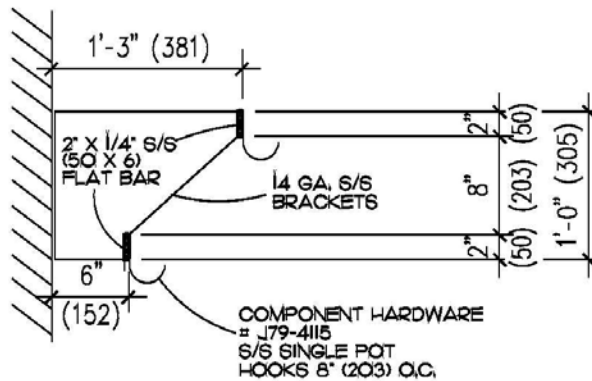
CLEVENGER ASSOCIATES

**WOOD TABLE
 DETAIL**

C-7-2



TYPE "1"



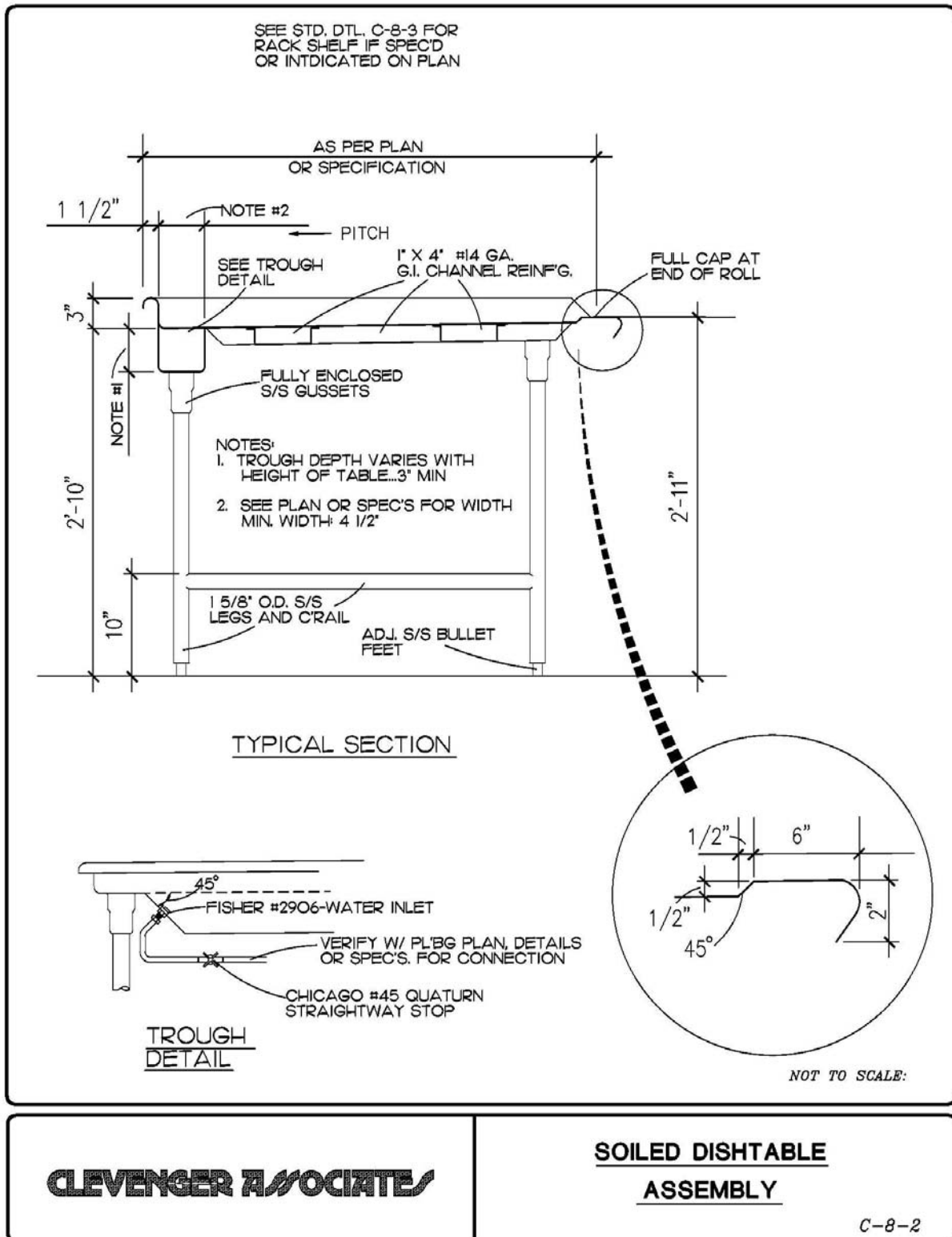
TYPE "2"

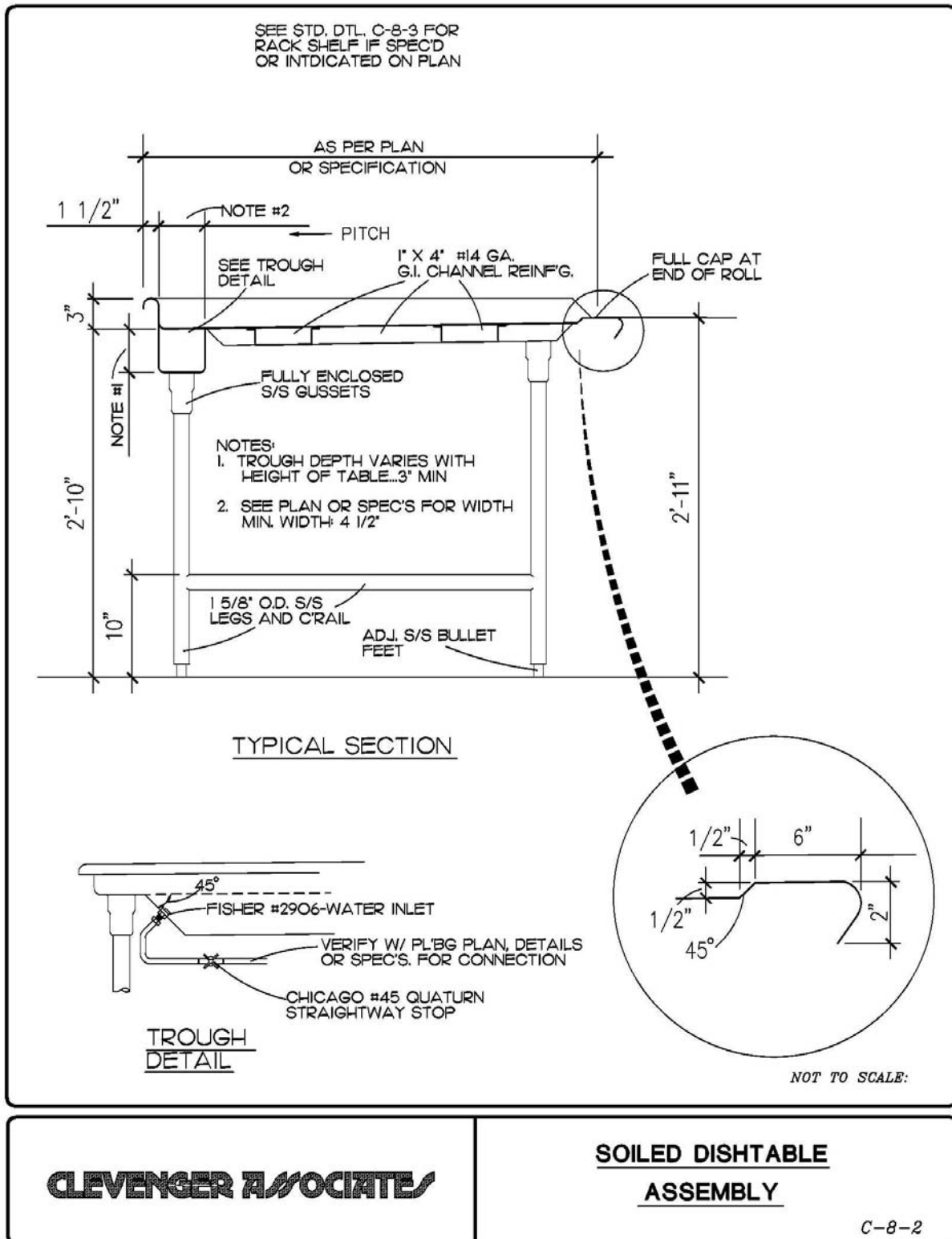
CLEVENGER ASSOCIATES

**WALL MOUNTED
 POT AND PAN RACK**

05/01

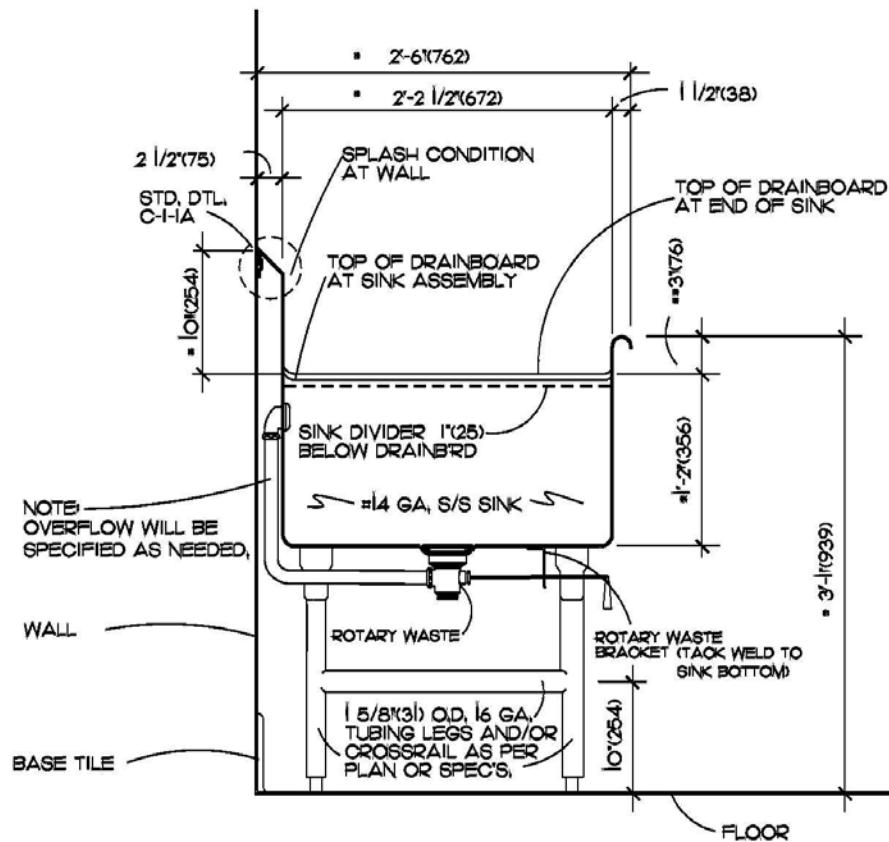
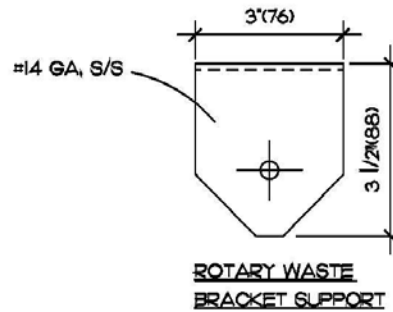
C-7-4A





NOTES:

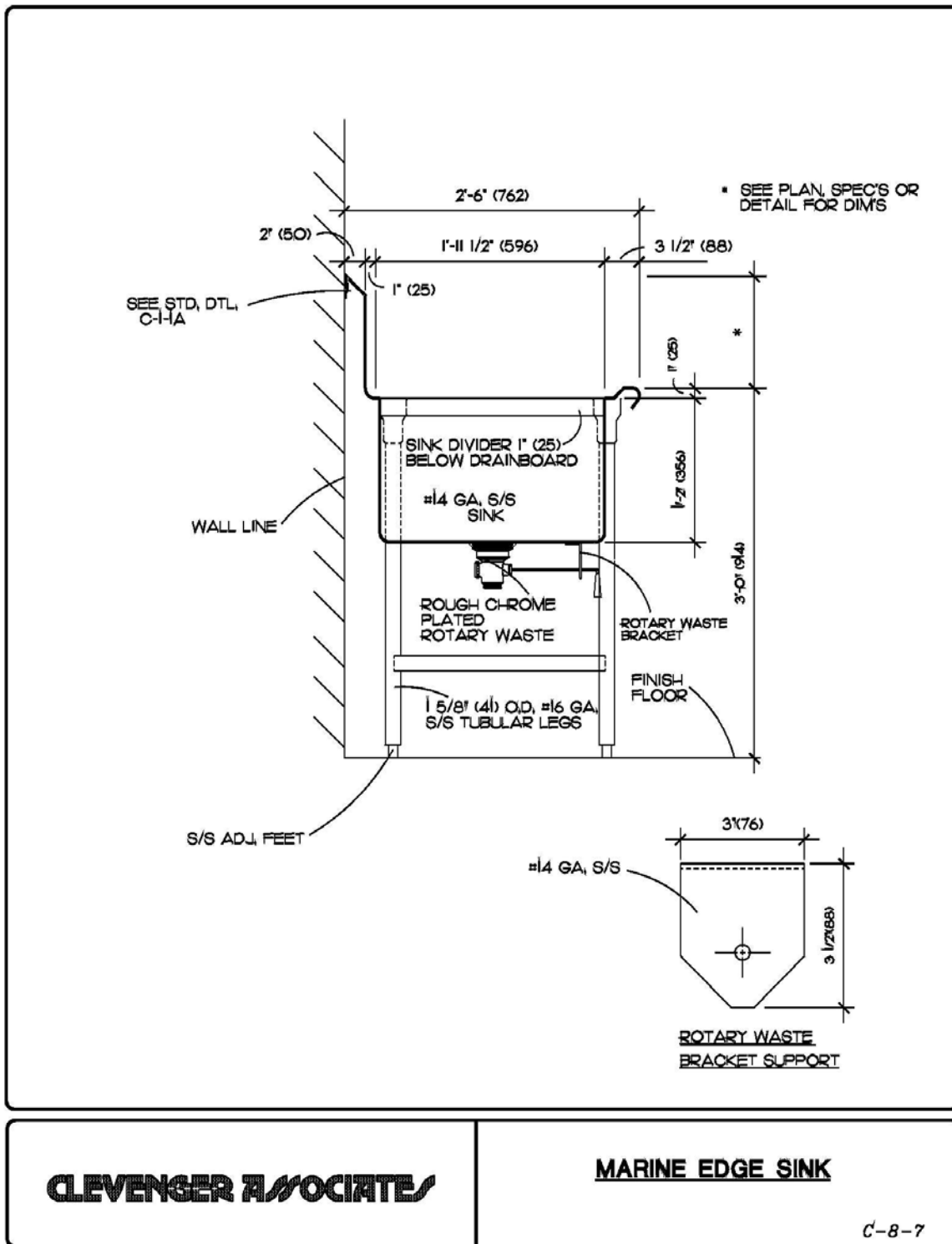
- OR AS SPECIFIED
- HEIGHT DIMINISHES
W/PITCH-MINIMUM
PITCH: 1/8"(3)/FT.

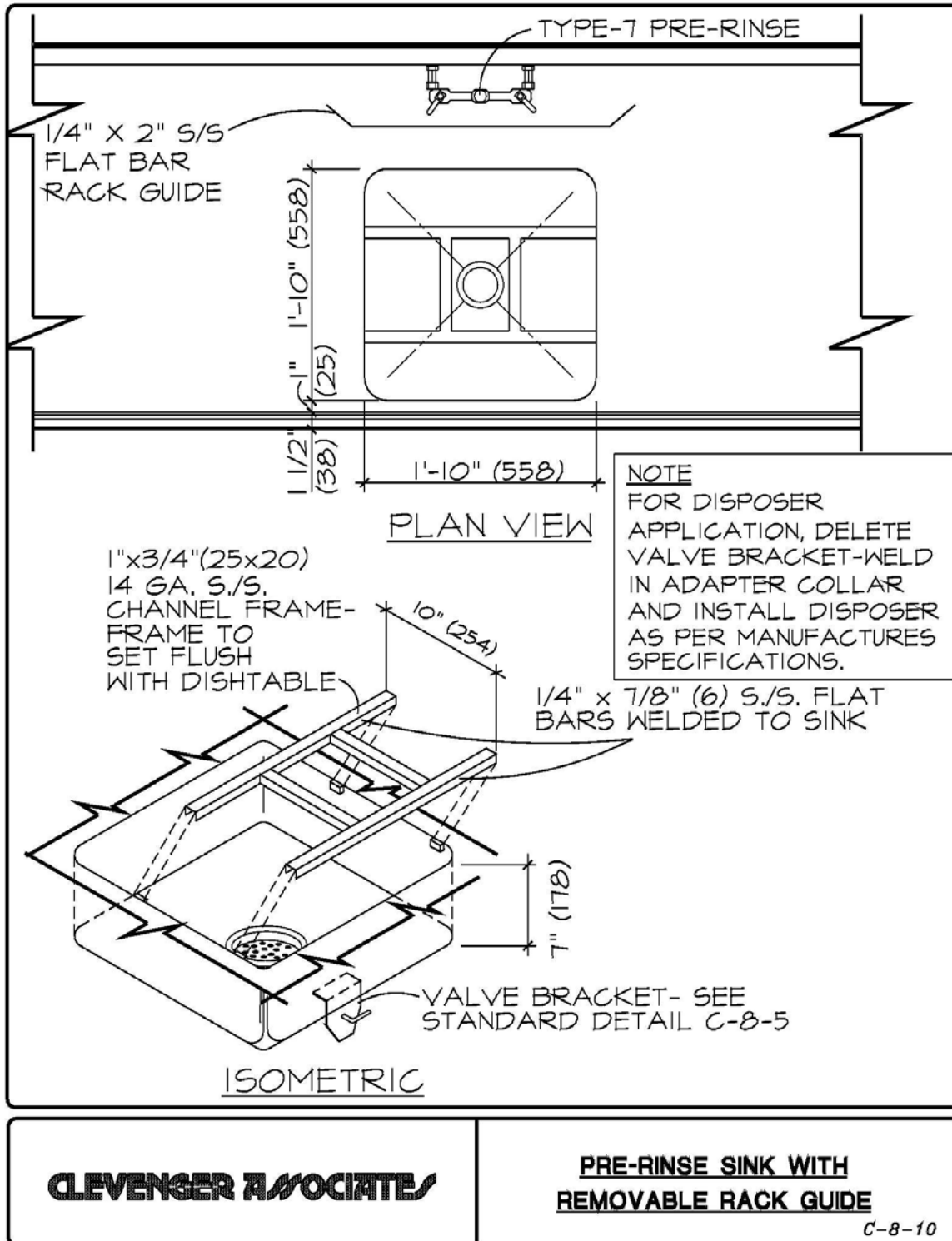


CLEVENGER ASSOCIATES

**SINK ASSEMBLY/
DISHTABLE SINK**

C-8-5





END OF SECTION 11 40 00

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manual roller shades with single rollers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, 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.
- C. Samples for Initial Selection: For openness of shadeband material.
 - 1. Shadeband Material: Not less than 6 inches square. Mark inside face of material.
- D. Samples for Verification: For selected color of roller shade.
 - 1. Shadeband Material: Not less than 6 inches square. Mark inside face of material.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.7 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.

1.8 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or equal:
 - 1. Mechoshade
 - 2. Hunter Douglas
 - 3. Solarfective
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.3 MANUAL, SINGLE-ROLLER SHADES

- A. 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.
 - 1. Roller Drive-End Location: Right side of inside face of shade.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

- B. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- C. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- D. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- E. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: Selected from manufacturer's standard profiles..
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches (76 mm).
 - 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard in height required to enclose roller and shadeband when shade is fully open, but not less than 3 inches (76 mm) >.
 - 3. Endcap Covers: To cover exposed endcaps.
 - 4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 - 5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Basis-of-Design Light-Filtering Fabric: MechoShade ThermoVeil.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
 - 3. Weave: Basketweave.
 - 4. Thickness: As selected from manufacturer's fabric selections.
 - 5. Weight:.030 oz/sq.yd. maximum
 - 6. Roll Width: manufacturer's standard width.
 - 7. Orientation on Shadeband: Up the bolt.
 - 8. Openness Factor: To be determined.
 - 9. Color: To Be determined.

2.5 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate unit widths as indicated on reflected ceiling plan. Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C).
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 - 1. Vertical Shades: If necessary for manufacturing or functional reasons, provide battens and seams at mullion locations and as required to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 2. Shades at Doors: Shadebands shall stop at the head of doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate 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.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

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.

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.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

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 123216 - MANUFACTURED PLASTIC-LAMINATE-FACED 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. Plastic-laminate-faced cabinets.
 2. Engineered wood plank benches and display case shelves
 3. Live edge wood slab display case shelves
 4. Mini-Peelers
 5. Glass cabinet shelves and doors
 6. Cabinet Hardware
- B. Related Requirements:
 1. Section 061000 "Rough Carpentry for wood blocking for anchoring casework.
 2. Section 096513 "Resilient Base and Accessories" for resilient base applied to plastic-laminate-faced casework.
 3. Section 123661 "Simulated Stone Counter Tops."
 4. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.3 DEFINITIONS

- A. Definitions in the AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.
- B. MDF: Medium-density fiberboard.
- C. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.5 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: 8-by-10-inch Samples for each type of finish.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.
- D. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.8 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.
 - c. EQ Credit Low Emitting Materials: Non-Structural Composite Wood: Documentation confirming the product has low formaldehyde emissions that meet the California Air Resource Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins, in accordance with Section 01 35 15, LEED Certification Procedures
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.11 FIELD 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. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWMAC's, and WI's "Architectural Woodwork Standards."
- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
- C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of 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 of components.
 - c. Failure of operating hardware.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Products proposed for substitution must have LCAs or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
- C. Products proposed for substitution must also be FSC certified wood products.
- D. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures

2.2 MANUFACTURERS

- A. 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:
- B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

2.3 CASEWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the AWMAC's, and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
 1. Grade: Custom.
- B. Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-faced cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 016000 "Product Requirements."
- C. Product Designations: Drawings indicate configurations of manufactured plastic-laminate-faced cabinets by referencing designations of Casework Design Series numbering system in Appendix A of the AWMAC's, and WI's "Architectural Woodwork Standards."

2.4 CASEWORK

- A. Design:
 1. Flush overlay.
- B. Grain Direction for Wood Grain Plastic Laminate: If applicable, refer to drawings.
- C. Exposed Materials:
 1. Plastic Laminate: Grade HGS.

- a. Colors and Patterns: As indicated by manufacturer's designations.

D. Semi-exposed Materials:

- 1. Thermoset Decorative Panels: Provide thermoset decorative panels for semi-exposed surfaces unless otherwise indicated.
 - a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.
- 2. Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
- 3. Unless otherwise indicated, provide specified edge-banding on all semi-exposed edges.

E. Concealed Materials:

- 1. MDF.

2.5 SOLID WOOD PLANKS

- A. Wood Species: White Oak
- B. Dimensions: 3/4" x 16" x Length
- C. Substrate: 3/4" Plywood (at bench only)
- D. Joints: Per Drawings.
- E. Location: Wall-hung bench and display case per drawings
- F. Finishing: Apply two-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat.

2.6 LIVE EDGE WOOD PLANKS

- A. Wood Species: White Oak
- B. Dimensions: 3/4" x 16" (minimum) x Length
- C. Joints: Per Drawings.
- D. Location: Display case per drawings
- E. Finishing: Apply two-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat.

2.7 MINI-PEELER POLES

- A. Wood Species: Western Cedar
- B. Dimensions: 4" Diameter x Length

- C. Location: Column Supports for Display Case
- D. Finishing: Apply two-coat, baked, clear finish consisting of a thermosetting catalyzed sealer and a thermosetting catalyzed conversion varnish. Sand and wipe clean between applications of sealer and topcoat.

2.8 MATERIALS

- A. Low-Emitting Materials: Fabricate casework, including countertops as indicated on the , with adhesives and composite wood products containing no urea formaldehyde.
- B. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- C. Softwood Plywood: DOC PS 1.
- D. MDF: ANSI A208.2, Grade 130; made with binder containing no urea formaldehyde.
- E. Hardboard: ANSI A135.4, Class 1 Tempered.
- F. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
 - 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. Abet Laminati Inc.
 - b. Arborite.
 - c. Formica Corporation.
 - d. Lamin-Art, Inc.
 - e. Nevamar; a Panolam Industries International, Inc. brand.
 - f. Pionite, a Panolam Industries International, Inc. brand.
 - g. Wilsonart.
- G. Edge-banding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 1 mm thick elsewhere.
- H. Thermoset Decorative Panels: Medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
- I. Edge-banding for Thermoset Decorative Panels: PVC or polyester edgebanding matching thermoset decorative panels.

2.9 COLORS AND FINISHES

- A. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.
- B. Plastic-Laminate Colors, Patterns, and Finishes: As indicated by manufacturer's designations.
- C. PVC Edge-banding Color: As selected from casework manufacturer's full range.

2.10 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
- B. Butt Hinges: Stainless-steel, semi-concealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, Type B01602, 170 degrees of opening, self-closing. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
- D. Pulls: Solid stainless-steel wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel flush pulls. Provide two pulls for drawers more than 24 inches wide.
- E. Door Catches: Zinc-plated, nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.
- F. Drawer Slides: BHMA A156.9, Type B05091.
 - 1. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches high and 24 inches wide.
 - 2. File Drawer Slides: Grade 1HD-200, for drawers more than 6 inches high or 24 inches wide.
 - 3. Pencil Drawer Slides: Grade 1, for drawers not more than 3 inches high and 24 inches wide.
- G. Drawer and Hinged Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
 - 1. Provide a minimum of two keys per lock and six master keys.
 - 2. Provide locks where indicated and at ALL lower / base cabinets doors.
- H. Display Cabinet with Glass Doors and Shelves: Sugatsune America, Inc 2885
 - 1. Glass Door Locks XL-GC03-C
 - 2. Upper Rollers, 53-3061-081
 - 3. Glass Door Upper Brackets, XL-GC06-C
 - 4. Glass Door Bottom Guide Brackets, XL-GC08-C
 - 5. Upper Rails, XL-GC06-UL1200
 - 6. Bottom Rails, XL-GC03-GL 1200, Matte Chrome.
- I. Tempered Float Glass Display Cabinets: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6 mm thick unless otherwise indicated.
- J. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.
- K. Adjustable shelf standards and brackets for wall-mounted and workstation shelving: KV Series 80 steel standards and Series 180 brackets with ANO finish

EXECUTION

2.11 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

2.12 CASEWORK INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Install casework level, plumb, and true; shim as required, using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch . Bolt adjacent cabinets together with joints flush, tight, and uniform.
- D. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch .
- E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWMAC's, and WI's "Architectural Woodwork Standards."
- F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- H. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

2.13 CLEANING

- 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. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 123216

SECTION 123661 - SIMULATED STONE COUNTERTOPS

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.
- B. Related Requirements:
 - 1. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-surface-material countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 – LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Low-Emitting Materials Submittals:
 - a. EQ Credit Low Emitting Materials: Non-Structural Composite Wood Documentation confirming the product has low formaldehyde emissions that meet the California Air Resource Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 3. Materials and Resources Submittals:
 - a. MR Credit BPDO – Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - b. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these

- locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Comply with applicable ATCM for formaldehyde resins, based on product type, in accordance with Section 01 35 15 - LEED Certification Procedures.
- B. Products proposed for substitution must also be FSC certified wood products.
- C. Products proposed for substitution must have a qualifying material ingredient declaration in accordance with Section 01 35 15, LEED Certification Procedures.

2.2 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
1. Front: Straight, slightly eased at top.
 2. Endsplash: Matching backsplash.
- B. Countertops: 1/4-inch-thick, solid surface material laminated to 3/4-inch-thick medium density fiberboard with exposed edges faced with 1/4-inch-thick, solid surface material.
- C. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.

2.3 COUNTERTOP BRACKETS

- A. Floating countertop wall bracket by ironsupports.com. Color to be white.

2.4 COUNTERTOP MATERIALS

- A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. MDF: ANSI A208.2, Grade 130; made with binder containing no urea formaldehyde.
- C. Adhesives: Adhesives shall not contain urea formaldehyde.
- D. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 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. Wilsonart.
 - b. E. I. du Pont de Nemours and Company.
 - c. Formica Corporation.
 - d. LG Chemical, Ltd.
 - e. Meganite Inc.
 - f. Samsung Chemical USA, Inc.
 - g. Transolid Div of Trumbull Industries.
 - 2. Type: Provide Standard Type unless Special Purpose Type is indicated.
 - 3. Colors and Patterns: Basis of Design colors are Empire State and Murren by Wilsonart.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet .
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 123661

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: All site furnishings shall be constructed and installed as shown on drawings and per manufacturer's recommendations.
- B. Provide coordination, assembly, and installation only for other Owner-procured site furnishings, including benches, chairs, tables, trash receptacles, and ash urns.
- C. Workmanship: Workmanship shall be of acceptable quality and performed to the satisfaction of the Owner.

1.2 RELATED SECTIONS

- A. Coordinate related work specified in other parts of the Contract Documents, including but not limited to the following:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 32 13 13 – Portland Cement Concrete Paving

1.3 SUBMITTALS

- A. Submit data sheets, specifications, and installation details on all site furnishings, for review and approval by Owner's Representative.
- B. Submit shop drawings for all items requiring fabrication and/or assembly.

1.4 LEED SUBMITTALS

- A. For components of this section submit the following in compliance with section 01 35 15 - LEED Certification Procedures.
 - 1. LEED Submittal Coversheet.
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with section 01 35 15 – LEED Certification Procedures.
 - i. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ensure that all specified furniture is delivered to site undamaged and protected while under project construction period prior to final acceptance.

PART 2 - PRODUCTS

2.1 WOOD BENCHES AND ARMCHAIRS

- A. 5' Villa Cedar Garden Bench
 - 2. Model #: WC-1GB
 - 3. Mounting Type: None
 - 4. Materials:
 - a. Wood: Kiln-Dried Clear Grain Premium Western Red Cedar
 - b. Finish: Clear Cedar Oil Stain
 - 5. Dimensions:
 - a. Total Height: 33 inches
 - b. Total Length: 63.5 inches
 - c. Seat Length: 60 inches
 - d. Seat Depth: 18 inches
 - e. Seat Height: Approx. 16 inches
 - f. Back Height from Seat: 20 inches
 - 6. Recycled Content:
 - a. 100% recyclable.
 - 7. Manufacturer: Adams All-Natural Furniture, www.cedarwoodfurniture.com, or approved equal.
 - a. Address: Knoxville, TN 37919
 - b. Phone: 1-877-595-8537
 - c. Email: sales@wishboneltd.com
- B. Villa Cedar Garden Chair
 - 1. Model #: WC-1CH
 - 2. Mounting Type: None
 - 3. Materials:
 - a. Wood: Kiln-Dried Clear Grain Premium Western Red Cedar
 - b. Finish: Clear Cedar Oil Stain
 - 4. Dimensions:
 - a. Total Height: 33 inches
 - b. Total Width: 25 inches
 - c. Total Depth: 28 inches
 - d. Seat Width: 22 inches
 - e. Seat Depth: 18 inches
 - f. Seat Height: Approx. 16 inches
 - g. Back Height from Seat: 20 inches
 - 5. Recycled Content:
 - a. 100% recyclable.

- A. Acceptable manufacturers include, but are not limited to, the following:

Adams All Natural Furniture, www.cedarwoodfurniture.com
Address: Knoxville, TN 37919
Phone: 1-877-595-8537
Email: sales@wishboneltd.com

2.2 SITE BENCHES

- C. Rutherford Bench – Angled Leg Wide Body

1. Model #: RW-6
2. Mounting Type: Surface
3. Materials:
 - a. 100% Recycled Plastic Slats
 - i. UV stabilized Re-plast™ recycled plastic slats made of thermoplastic polymers.
 - ii. Color: Redwood
 - b. Powder coated Aluminum Frame
 - i. Color: Timeless Rust
 - c. Warranty: 10 year limited.
4. Dimensions:
 - a. Total Height: 34.5 inches
 - b. Seat Height: 17.5 inches
 - c. Seat Depth: 17 inches
 - d. Total Length: 5 feet
 - e. Weight: 135 lbs
5. Recycled Content:
 - a. 64% recycled content by weight.
 - b. 100% recyclable.

- B. Acceptable manufacturers include, but are not limited to, the following:

Wishbone Site Furnishings
Website: www.wishboneltd.com
Address: #210-27090 Gloucester Way, Langley, BC V4W 3Y5
Phone: 1-866-626-0476
Email: sales@wishboneltd.com

2.3 BIKE RACKS

- D. Beselt 2 Space Bike Rack

2. Model #: BBRGP-37
3. Mounting Type: Surface
4. Materials:
 - a. 100% Recycled Plastic Slats

- i. UV stabilized Re-plast™ recycled plastic slats made of thermoplastic polymers.
 - ii. Color: Redwood
 - b. Powder coated Aluminum Frame
 - i. Color: Timeless Rust
 - c. Warranty: 10 year limited.
 - d. Stainless steel bolt down kit.
- 5. Dimensions:
 - a. Height: 36.5 inches
 - b. Depth: 3.5 inches
 - c. Width: 24 inches
 - d. Weight: 50 lbs.
- 6. Recycled Content:
 - a. 10% recycled content by weight.
 - b. 100% recyclable.
- C. Acceptable manufacturers include, but are not limited to, the following:
 - Wishbone Site Furnishings
 - Website: www.wishboneltd.com
 - Address: #210-27090 Gloucester Way, Langley, BC V4W 3Y5
 - Phone: 1-866-626-0476
 - Email: sales@wishboneltd.com

2.4 TRASH RECEPTACLES

- A. Acceptable manufacturers include, but are not limited to, the following:
 - Wishbone Site Furnishings
 - Phone: 1-866-626-0476
 - Location: Langley, BC Canada
 - Email: sales@wishboneltd.com
 - Website: www.Wishboneltd.com
- B. Urban Form Two Stream Recycling Station
 - 1. Model Number: UFRS-44
 - 2. Dimensions: 42"H x 23.5" D x 44.5" W
 - 3. Weight: 206 lbs.
 - 4. Capacity: 60 Gal
 - 5. Mounting: Surface-Mount
 - 6. Slat Material: Produits Re-Plast Avantage™ Recycled Plastic Slats in Redwood
 - 7. Frame Material: Durable Powder Coated Aluminum in Black Super Texture
 - 8. Recycled Content:

- a. 69% recycled content by weight.
- b. 100% recyclable.

2.5 PET WASTE STATION

- A. Acceptable manufacturers include, but are not limited to, the following:

Dog Waste Depot
Phone: 1-800-678-1612
Location: San Diego, CA
Website: www.dogwastedepot.com

- B. Dog Waste Station w/ONEpull Bag System

- 1. Model Number: DEPOT-022-B
- 2. Dimensions:
- 3. Round Waste Can: 13" DIA x 26" HT
- 4. Post: 73" above Ground 14" below ground
- 5. Mounting: In Ground
- 6. Material: Aluminum/Metal Screen Printed and Powder Coated in Green

2.6 ASH URNS

- A. Acceptable manufacturers include, but are not limited to, the following:

thePark and Facilities
Phone: 866-280-9894
Email: sales@theparkcatalog.com
Website: <https://www.theparkcatalog.com/>

- B. Model: Smokers' Outpost® Site Saver™

- 1. Model Number: 108-1114
- 2. Dimensions: 42-inch height x 12-inch diameter
- 3. Weight: 7 lbs.
- 4. Mounting: Surface-mount with optional security hardware
- 5. B/L Description: Plastic Art 156600-03 Sub 2-4 PCF CL250
- 6. Material Process: Blow-molded, HDPE with PCR
- 7. Color: Sedona
- 8. Pail Liner:
 - a. 10-20% recycled steel
 - b. Finish: Galvanized
 - c. Capacity: 5 Quart
- 9. Recycled Content:
 - a. 69% recycled content by weight.
 - b. 100% recyclable.

2.7 ACCESSIBLE RAISED PLANTING BEDS

- A. Custom Planters per details
 - 1. Wood: Kiln-Dried Clear Grain Premium Western Red Cedar
 - 2. Finish: Clear Cedar Oil Stain
 - 3. Hardware: Stainless Steel
 - 4. Liner: Landscape filter fabric
 - 5. Drainage layer: 1/4" pea gravel

Or

- B. Dilative Alternative:
 - 1. Medium VegTrug™ Patio Garden, or approved equal.
 - 2. Model #: VTNMD0367-US
 - 3. Mounting type: Surface
 - 4. Wood: FSC-certified, sustainable, plantation grown fir
 - 5. Finish: non-toxic stain
 - 6. Color: Charcoal
 - 7. Size: 70" L x 30.7" W x 31.5"H
 - 8. Internal depth of V section is 16.8 inches
 - 9. Soil Volume: 15 cubic feet (110 gallons).
 - 10. Weight: 61 lbs.
 - 11. <https://eartheasy.com/>

PART 3 - EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 PREPARATION

- B. Verify that site conditions are ready to receive work and dimensions are as indicated on drawings.
- C. Beginning of installation means acceptance of existing conditions.
- D. Deliver inserts and rough-in items to site at appropriate time for built-in supports and attachments.

3.3 LAYOUT

- A. Layout of all site furnishings, site improvement items, bases, and footings shall be approved by Owner's Representative prior to installation.

3.4 INSTALLATION

- A. General: All installations shall be plumb, level, and secure, and per manufacturer's directions.
- B. Wood benches and armchairs: shall be surface mounted, securely, and rigidly anchored to substrate, as shown on drawings, and as directed by Owner's Representative.
- C. Log benches: shall be set in place on compacted crushed rock and CIP concrete surfacing, as shown on drawings.
- D. Trash and ash receptacles: shall be surface mounted, securely, and rigidly anchored to substrate. Provide assembly and installation for 5 trash receptacles and 6 ash urns.
- E. Landscape timbers: shall be installed as shown on drawings. Make minor adjustments to stair locations to provide smooth transitions in grade and path alignment. Provide at least 5 linear feet of level path between sets of stairs and path intersections.

3.5 CLEAN UP

- A. Clean all site furnishings and adjacent paving prior to Owner's acceptance of the work.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 21 13 00

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

1.2 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.
- F. ITS (DIR) - Directory of Listed Products; current edition.
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 1963 - Standard for Fire Hose Connections; 2019.
- I. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2018.
- J. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2018.
- K. UL (DIR) - Online Certifications Directory; Current Edition.
- L. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Designer's qualification statement.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.
- J. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.5 QUALITY ASSURANCE

- A. Comply with FM (AG) requirements.
- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.
- E. Equipment and Components: Provide products that bear FM (AG) label or marking.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Comply with NFPA 13.
- C. Water Supply:
 - 1. Owner provided flow test data: _____
 - 2. Flow test data will be provided by owner.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections where indicated on Civil documents.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 SPRINKLERS

- A. Suspended Ceiling Type: Recessed pendant type with matching push on cover plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard or extended.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- B. Exposed Area Type: Pendant, standard, or upright type with guard.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard or extended.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Dry Sprinklers: Exposed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard or extended.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Guards: Finish to match sprinkler finish.
- F. Flexible Drop System: Stainless steel, multiple use, open gate type.
 - 1. Application: Use to properly locate sprinkler heads.
 - 2. Include all supports and bracing.
 - 3. Provide braided type tube as required for the application.
 - 4. Manufacturers:

2.3 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 - 1. Activate electric alarm.
 - 2. Test and drain valve.
 - 3. Replaceable internal components without removing valve from installed position.
- B. Backflow Preventer: Double check valve assembly backflow preventer with drain and butterfly or OS&Y gate valve on each end.
 - 1. Double check valve assembly shall be suitable for vertical assembly orientation inside sprinkler riser room.
 - 2. Backflow preventer shall be Ames Deringer 20/20G series or equivalent.
- C. Test Connections:
 - 1. Backflow Preventer Test Connection:
 - a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
- D. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- E. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

2.4 FIRE PUMPS

- A. Provide complete fire pump package, including fire pump, electric motor drive, controller, and accessories.
- B. Vertical in-line type; UL 448 and UL 778; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 250 psi.
- C. Horizontal base-mounted type; UL 448; and UL 778 horizontal shaft, single-stage, double suction, direct connected, horizontally split casing, for 250 psi maximum working pressure.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Provide approved backflow preventer assembly at sprinkler system water source connection.
 - 1. Locate backflow preventer in fire sprinkler riser room.
- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- E. Locate outside alarm gong on building wall as indicated.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- J. Install and connect to fire pump system in accordance with NFPA and fire sprinkler system flow requirements.
- K. Flush entire piping system of foreign matter.
- L. Install guards on sprinklers where required by NFPA 13.
- M. Hydrostatically test entire system.
- N. Require test be witnessed by Fire Marshal.
- O. The fire protection contractor shall be responsible for system layout, design, and coordinating pipe placement and routing of piping with other trades.
 - 1. Ductwork and other piping systems have routing priority over fire protection piping.
 - 2. Fire protection piping shall be routed to avoid blocking building openings such as doors, windows, skylights, relites, etc.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

3.3 FIRE PUMPS

- A. Install in accordance with NFPA 20.
- B. Install diesel engine drive in accordance with NFPA 37.

- C. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.
- D. Install piping in accordance with NFPA requirements. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.
- E. Provide drains for bases and seals, piped to and discharging into floor drains.
- F. Mount pump on vibration isolators.
- G. Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.
- H. Perform field acceptance tests in the presence of Fire Marshal.

3.4 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Common work results for Division 22 (plumbing).

1.2 SUMMARY

- A. Section includes general requirements that apply to the entirety of Division 22 - Plumbing, both interior and exterior to the building, as indicated on the plans and specified herein.
- B. All specification sections with Division 22 - Plumbing are complementary. All specification sections within Division 22 shall be considered to reference each other.
- C. Provide all plumbing work as indicated in the drawings and specified herein.

1.3 REFERENCE STANDARDS

- A. AISC Steel Handbook.
- B. ASHRAE Applications Manual.
- C. ASME 31.9 - Building Services Piping.
- D. ASTM D1557 - Method of Test for Moisture Density Relations of Soils.
- E. IBC - International Building Code.
- F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.
- G. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
- H. NFPA 70 - National Electrical Code.
- I. RCW 18.106 - Plumbers.
- J. SMACNA Duct Construction Standards, Metal and Flexible.
- K. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
- L. UPC - Uniform Plumbing Code.
- M. WAC 51-11C - Washington State Energy Code, Commercial Provisions.

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide product data for all components and equipment provided under this Division.
 - 1. Product sheets with more than one item or option shown shall have the product(s) and options to be used on the project clearly identified.
 - 2. Any equipment or materials installed or furnished without prior approval of the Owner's Representative shall be rejected and such materials will be required to be removed and replaced with approved materials at the expense of the Contractor.
- C. Shop Drawings:
 - 1. Shop drawings shall be submitted for review and approval prior to beginning work.
 - 2. Shop drawings shall indicate routing of piping and location of all equipment to be provided, and shall reflect coordination with other disciplines and existing conditions.

3. Shop drawings shall be provided for the following systems:
 - a. Plumbing
4. Provide coordination shop drawings showing all project scope(s) including architectural, structural, mechanical, electrical, and specialty contractors.
- D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.
- E. Field Quality Control Submittals: Indicate test reports, inspection reports, and commissioning reports.
- F. Project Record Documents:
 1. Record actual routing of installed piping, including elevation (or depth for buried piping).
 2. Record actual equipment and components installed, as well as locations.
 3. RFI's, change orders, and the like shall be noted on the Record Documents where these affect the layout or other aspect of project shown on the documents. References to these shall include the RFI/change order number as well as written description(s), sketch(es), etc., indicating the change or clarification.
 4. Record actual location of installed valves and control components.
 - a. Include riser diagram(s) and schedule of valve tags and locations.
 5. Final record documents:
 - a. Upon completion of the project the as-built information shall be neatly transferred to a clean set Plans. This set of Plans shall be submitted for final approval and acceptance.
- G. Operation and Maintenance (O&M) Data:
 1. Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.
 2. Include manufacturer's warranty information, including any extended warranties, or certifications of warranties required for specific products, systems, or installations.
 3. Include certification of inspection(s) from the Authority Having Jurisdiction for the applicable work scope(s).
 4. Include certification of training.
 5. Include certification of Contractor's one-year warranty of materials and workmanship, including effective date(s) of warranty period.
 6. Include SDS sheets for all chemicals, adhesives, etc., utilized in the construction process as well as those utilized by or in the constructed system(s).
- H. Seismic support calculations and any related required certification(s).
- I. Warranty Information:
 1. Certificate of installing contractor's one-year warranty.
 - a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
 2. Certificate of product manufacturer's warranty.
 - a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
 3. Certificate of extended warranty.
 - a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
 - b. Provide extend warranty for:
 - 1)

1.5 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in manufacturing products specified in Division 22 with a minimum of three years documented experience.
- B. Contractor: The contractor shall be a Washington State licensed plumber.
- C. Backflow Testing: All testing of backflow prevention equipment shall be done by a Washington State Certified Backflow Assembly Tester (BAT) certified to work in buildings.
- D. Electrical Work:
 - 1. Contractor: Electrical work required under this Division shall be performed by a Washington State Licensed Electrician.
 - 2. Electrical work required under this Division shall require an electrical permit.
 - a. Electrical permit shall be procured by the Division 22 contractor or their electrical subcontractor.
 - 3. Electrical Equipment
 - a. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection(s), such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).
 - b. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.
 - c. It shall be the responsibility of the Contractor to meet the Agency Approval requirements of this section. Any allowance for agency costs to provide appropriate label for a piece of equipment must be included in this Bid and Contract. Failure by the Contractor or supplier to obtain labels associated with agency approval prior to bid shall be sufficient cause for the Contractor to obtain all such labels and approvals at no additional cost to Owner.
- E. Performance Certification: All equipment performance (water flow, heating capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.
- C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.
- D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.7 DEFINITIONS

- A. The term "approved equal" means final approval by the Architect of a material or piece of equipment substituted for that which is shown in the Specifications or Plans.
- B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.

- C. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the General Contractor (GC).

1.8 MISCELLANEOUS REQUIREMENTS

- A. Intent of Drawings
 - 1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in piping. Provide additional fittings, offsets and extensions in piping systems and related items to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping where conflict exists with other plumbing or mechanical systems, structural elements, architectural elements, or electrical systems, or other project work scope(s). Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor's own expense.
 - 2. Examine the Architectural, Civil, Structural, Electrical, and other project drawings before work is started. Consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.
- B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.
- C. Scheduling: Comply with requirements of Division 1.
- D. As-Specified Equipment: These specifications and drawings; generally list only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition the listed product is the basis of the design regarding physical size, capacity, electrical power requirements and performance. The product so identified is designated "as specified."
- E. Prior Approvals:
 - 1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.
 - 2. Request for Approval must be submitted in accordance with Division 1 requirements.
 - 3. Supplier and/or Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment; shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality.
- F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. For example, if one Section (such as copper piping) applies to both plumbing and hydronics, apportion the appropriate amount to each area of work.

1.9 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.

- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for general demonstration and training requirements.

1.10 REQUESTS FOR INFORMATION

- A. Refer to Division 1 for Request for Information (RFI) requirements.

PART 2 PRODUCTS

2.1 GENERAL

- A. See technical specifications for detailed product specifications.

2.2 DAMAGED OR REJECTED MATERIALS

- A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.3 FIRE INTEGRITY

- A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, supports, conduit, and any other system and appurtenance provided by Division 22. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

PART 3 EXECUTION

3.1 CODE COMPLIANCE

- A. The Contractor shall comply with all applicable codes and requirements including but not limited to:
 - 1. Washington State Department of Health requirements.
 - 2. International Building Code, including local amendments.
 - 3. International Fuel Gas Code, including local amendments.
 - 4. International Mechanical Code, including local amendments.
 - 5. International Fire Code, including local amendments.
 - 6. Uniform Plumbing Code, including local amendments.
 - 7. National Electrical Code (NFPA 70), including local amendments.
 - 8. Washington State Energy Code.
 - 9. Requirements of the local Authority Having Jurisdiction (AHJ).
 - a. Authority Having Jurisdiction: Chehalis Tribe.

3.2 LAYING OUT WORK

- A. Locate all general reference points as established by the General Contractor and take such action as is necessary to prevent their destruction; lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution. Coordinate the utility installation with the final site grading and elevations. Locate existing utility lines that will be affected by the

building location before any footing work begins. Report conflicts with the Plans before proceeding with the work. Failure to follow reasonable precautions with regards to this instruction will require Contractor to alter the work at the Contractor's expense.

3.3 ELECTRICAL WORK

- A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC (NFPA 70) and all applicable codes.
- B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain & pay for all required permits & fees.
- C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.4 WORKMANSHIP

- A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.5 EXCAVATION - GENERAL

- A. Provide all necessary excavation and shoring required for the proper installation plumbing systems.
- B. Slope sides of excavation to comply with local codes and ordinances having jurisdiction.
- C. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- D. Sewer trenches shall be excavated to the grade with the bottom rounded to the outside of sewer pipes.
- E. Bell holes shall be hand excavated to ensure the pipes resting for their entire length upon the bottom of the trench.
- F. In case of sewer lines in rock excavation, the excavation shall be made at least 4 inches deeper than required and backfilled with sand to outside invert grades to provide cushion.
- G. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- H. Secure approval to excavate for all trenches near or under footings and for backfilling of such trenches.
- I. No underground lines shall be covered until the installation has been approved by both Owner's technical representatives and the Local AHJ.

3.6 EXCAVATION DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

- C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collection or run off areas. Do not use trench excavations as temporary drainage ditches.

3.7 EXCESS EXCAVATION MATERIAL

- A. Legally dispose of dirt and debris from excavation at an off-site location.

3.8 PIPE BEDDING

- A. Provide sand or pipe zone bedding mix for pipe bedding.
 - 1. Native soil shall not be used as pipe bedding material.
 - 2. Remove all rocks or other objects from bedding material that may damage piping.
- B. Pipe bedding material shall be provided all around the piping, to the following minimum amounts:
 - 1. Below bottom of pipe: 4 inches
 - 2. Above top of pipe: 4 inches
 - 3. From each side of pipe: 4 inches
 - 4. Pipe bedding shall be compacted to ensure even support for all buried piping systems.

3.9 BACKFILL

- A. All backfill shall be thoroughly mechanically compacted.
- B. Excess excavation shall be backfilled with gravel or sand and mechanically compacted to give full support to the pipe.
- C. No cinders shall be used for backfilling where steel, iron or copper pipe is used.
- D. All soil foundation areas which will in any manner support any load bearing building components shall be compacted, by the use of mechanical tampers, to at least 95% of the maximum density of the soil foundations as determined by the compaction control test in accordance with the "Method of Test for Moisture Density Relations of Soils, ASTM D1557." The moisture control at the time of compaction shall be uniform throughout the area and shall not vary more than 5% above or below the optimum moisture content as determined by the above described "Compaction Control Test." Place fill in 8 inch loose layers, each layer compacted.

3.10 PIPE INSTALLATION

- A. Lay pipe in straight lines with uniform slope, leaving no pockets. Care shall be taken to keep all foreign materials out of the pipes during installation. Where ground water is present, provide suction pumps to keep trenches free of water, and cap end of piping exposed to ground water when work is interrupted.
- B. All underground piping used for the distribution of domestic water or waste drainage systems, which are located outside the building perimeter, shall be buried a minimum of 24 inches from finish grade to top of pipe.
- C. All piping and ductwork run above the floor shall not be located over electrical panels or switchboards except where located above the structural ceiling. This shall include, but not be limited to, sanitary waste and vent, storm drain and rainleaders, domestic water, and condensate drain piping.
 - 1. Where routing above electrical distribution equipment cannot be avoided, stainless steel drip pans shall be provided. Drain piping from drip pans shall be routed to nearest indirect drain location (such as standpipes, floor/funnel drains, floor sinks, air gap fittings, etc.).

- D. Isolation valves shall be provided on inlets and outlets of all major pieces of equipment to facilitate serving and removal of such equipment without the necessity of draining the associated system.
- E. Provide detectable metallic underground tape for all buried piping. Install between 6"-12" above piping. Color scheme and text shall be appropriate to the associated system, and can be the manufacturer's standard color and description.

3.11 OPENINGS IN PIPES

- A. Keep closed during the work.

3.12 WALL AND FLOOR PLATES AND ESCUTCHEONS

- A. Where pipes pass through finished walls, floors or ceilings, provide chromium plates, with suitable set screws or other approved holding devices. Where extended sleeves are necessary, the plates shall be of sufficient depth to cover the sleeves.

3.13 INSERTS

- A. Inserts in concrete for the suspension of piping and equipment; shall be provided by this Contractor unless otherwise noted on the Plans. Provide as necessary for support of systems installed.
- B. Inserts in "poured in place" concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal.

3.14 CUTTING AND PATCHING

- A. General:
 - 1. Provide all saw cutting, core drilling, and other work (including patching) necessary for installation of plumbing systems.
 - 2. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific approval prior to cutting any concrete reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.
 - 3. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
 - a. Reinforcing steel: 2"
- B. New Work: Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.
- C. Existing Structure:
 - 1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
 - 2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done patched to match the adjacent surface.
 - 3. Contractor shall locate all steel in existing structure using x-ray or similar scanning equipment prior to cutting into existing structure.

3.15 COORDINATION WITH CONTROLS INSTALLATION

- A. Review the controls section of Division 23 and the drawings. Provide installation of any components normally done by mechanical trades (installation of pipe wells, fittings, etc.) that are provided in the Control Specification Section specific to systems in Division 22.

3.16 MAINTENANCE AND OPERATION ACCESS

- A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
 - 1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
 - 2. Access door locations shall be approved by the Architect prior to installation.
- B. Access Panels
 - 1. Provide access panels for all concealed equipment, valves, and the like that requires adjustment or service access, as well as for all wall cleanouts. Panel locations shall be carefully selected on the job so as not to be located behind cabinets, lights, etc.
 - a. Coordinate with the work of other Contractors before installing panels.
 - b. Panels shall be prime coated and painted to match surrounding surface.
 - c. In finished areas, including ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.
 - d. Panels shall be size appropriate for the service intended.
 - e. Provide UL labeled fire rated access doors for one or two-hour rated walls and ceilings.
 - f. Install before surrounding surfaces have been painted.
 - g. Access panel doors shall have cylinder lock latch, all keyed alike.
 - h. Provide access doors in ceiling or wall adjacent to all fire damper locations.
 - i. Verify with Architect the location and finish of all access panels.
 - j. Panels shall be J.R. Smith or equal.

3.17 SEISMIC SUPPORT

- A. Piping: Support piping per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

3.18 FIRE INTEGRITY

- A. Maintain the fire rating of all assemblies (wall, ceiling, floor, etc.) penetrated by mechanical systems. Provide approved firestopping materials as previously specified, and install in accordance with the conditions of the material UL listing.

3.19 PRESSURE TESTS AND IN-SERVICE TEST

- A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Pipe testing shall be either as specified in the appropriate specification section, or as specified in the applicable plumbing or mechanical code. Tests shall be maintained until approved.
- B. Notifications shall be sent to the following parties 48 hours in advance of all tests:

1. Architect.
2. Owner.
3. Authority Having Jurisdiction over the specific work to be inspected.
 - a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.
- C. No systems, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.
- D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.
- E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.
- F. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from the date of final acceptance, and shall repair or replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.20 STARTUP, BALANCING AND COMMISSIONING

- A. Equipment Startup
 1. Refer to Section 23 08 10 for startup requirements.
 2. Refer to individual technical sections for specific startup requirements.
 3. Equipment startup shall be performed by factory-trained and certified technicians.
- B. Testing and Balancing
 1. Refer to Section 23 05 93 for testing and balancing requirements.
- C. Commissioning
 1. Refer to Section 23 08 00 for general commissioning requirements.
 2. Refer to individual technical sections for specific commissioning requirements.
 3. The commissioning agent shall be hired directly by the Owner.
 4. Provide system startup, adjustment, functional testing, and documentation to demonstrate compliance with design documents. Provide documentation to meet basic commissioning requirements of Washington State Energy Code section C408.

3.21 CLEANING UP

- A. Comply with requirements of Division 1.
- B. Pipes shall be maintained as clean as possible during construction, and shall be blown clean before the building field painting operations are started. Piping shall be thoroughly cleaned before systems are operational. Strainers shall be cleaned prior to turning the system(s) over to the owner.
- C. All equipment and material installed by this Contractor shall be properly protected from damage during the course of construction.
- D. Enamelware or china fixtures around which plaster is installed or paint is applied shall be covered with heavy wrapping paper thoroughly secured.
- E. Fixtures and equipment shall be thoroughly cleaned before final inspection. Remove all labels from plumbing fixtures.
- F. In utility rooms and other spaces where piping such as domestic water, condensate drains, stormwater, rainleader, sanitary sewer, or vent have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect these pipes. Wood or

other such material is acceptable. Where duct plenums or duct runs interfere with normal traffic pattern of maintenance personnel, the Mechanical Contractor shall provide a wooden bridge over the ducts to prevent damage. Provide handrails for bridge(s) where required by code.

3.22 SPECIAL PROTECTION

- A. Exercise maximum precaution to provide positive protection for the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.
- B. Any damage to the building, systems, or property, caused by the Contractor shall result in the Contractor repairing or replacing the damaged item(s) at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.
- C. In attic or other spaces where piping has been installed at floor level and interferes with foot traffic, the Contractor shall provide permanent covers to protect these items. Wood or other such material is acceptable. Provide handrails where required by code.

3.23 CAULKING

- A. Caulk all openings and flash around all piping, equipment, and ducts passing through roof, floor, and walls.
- B. All caulking shall be waterproof, zero-VOC, and LEED qualified type.
- C. Refer to paragraph "Fire Integrity" for all rated wall, ceiling, floor, and other penetrations.

3.24 FINAL INSPECTION

- A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete. Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.25 INSTRUCTION PERIODS

- A. Refer to Division 1 for additional demonstration and training requirements.
- B. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's staff.
- C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings; followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.
- D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two weeks prior to date when ready to conduct instruction and demonstrations; receive approvals of proposed date prior to making final arrangements.

3.26 ON SITE OBSERVATIONS AND SAFETY MEASURES

- A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.27 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

- A. General: Continuity of utilities services in the building shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services; shall be accomplished in accordance with the following requirements.
- B. Shutdowns:
 - 1. While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings.
 - 2. Shutdowns longer than 2 hours shall be coordinated with and approved by the Owner at least 1 week in advance.
 - 3. Shutdowns less than 2 hours shall be coordinated with and approved by the Owner at least 48 hours in advance.
- C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.
- D. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

3.28 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - 2. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 3. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 4. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.29 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.2 REFERENCE STANDARDS

- A. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
- B. FM (AG) - FM Approval Guide; current edition.
- C. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Maintenance Data: Include adjustment instructions.
- D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.
- E. Manufacturer's warranty information.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Inner Hose: Bronze.
- B. Exterior Sleeve: Braided bronze.
- C. Pressure Rating: 125 psi and 450 degrees F.
- D. Joint: As specified for pipe joints.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/4 inch on each side of installed center line.
- G. Application: Copper piping.

2.2 EXPANSION LOOPS - HOSE AND BRAID

- A. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.
- B. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- C. Flexible Connectors: Flanged, braided type with wetted components of stainless steel or bronze, sized to match piping.
 - 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
 - 2. End Connections: Same as specified for pipe jointing.
 - 3. Provide necessary accessories including, but not limited to, swivel joints.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- D. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- E. Grooved piping may be substituted instead of flexible connectors for vibration isolated equipment. Grooved piping need not be anchored.

3.2 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.2 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

- B. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 - 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Modular/Mechanical Seal:
 - 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 - 2. Provide watertight seal between pipe and wall/casing opening.
 - 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 - 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations:
 - 1. Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 - 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 - 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.

- b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
- 3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a water-tight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.4 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.
- C. Static pressure gauges.

1.2 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).
- D. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2015.
- E. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2015.
- F. AWWA C702 - Cold-Water Meters -- Compound Type; 2015.
- G. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.4 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.1 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.
- B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.
- D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.2 STEM TYPE THERMOMETERS

- A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 - 1. Size: 7 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Accuracy: 2 percent, per ASTM E77.
 - 4. Calibration: Degrees F.

2.3 DIAL THERMOMETERS

- A. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
 - 1. Size: 3-1/2 inch diameter dial.
 - 2. Lens: Clear glass.
 - 3. Accuracy: 1 percent.
 - 4. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.5 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

2.6 STATIC PRESSURE GAUGES

- A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- B. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.
- C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation. Provide siphon on gauges in steam systems.
- D. Coil and conceal excess capillary on remote element instruments.

- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Applications.
- B. General requirements.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Globe valves.

1.2 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2017.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- F. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017.
- G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
- H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- I. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- J. AWWA C606 - Grooved and Shouldered Joints; 2011.
- K. MSS SP-67 - Butterfly Valves; 2011.
- L. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.
- M. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
- N. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- O. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011.
- P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- Q. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- R. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. Project record documents.

- a. Valve schedule: Schedule shall indicate valve type, service, location, size.
- b. Drawings: Drawings shall be marked up with all valve locations numbered to match valve schedule.
- 3. O&M data
- 4. Warranty information:
 - a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.

1.6 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball or butterfly.
 - 2. Shutoff: Ball or butterfly.
 - 3. Dead-End: Single-flange butterfly (lug) type.
 - 4. Throttling: Provide globe, ball, or butterfly valves.
 - 5. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.
 - b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with center-guided, resilient seat check valves.
- B. Domestic, Hot and Cold Water Valves:
 - 1. 2 NPS and Smaller:
 - a. Bronze and Brass: Provide with solder-joint or threaded ends.
 - b. Ball: Three piece, full port, brass or bronze with brass trim.
 - c. Bronze Swing Check: Class 125, bronze disc.
 - d. Bronze Globe: Class 125, bronze disc.
 - 2. 2-1/2 NPS and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.

- b. Iron Ball: Class 150.
- c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
- d. Iron Grooved-End Butterfly: 175 CWP.
- e. Iron Swing Check: Class 125, metal seats.
- f. Iron Grooved-End Swing Check: 300 CWP.
- g. Iron Globe: Class 125.

2.2 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 - 1. Handwheel: Valves other than quarter-turn types.
 - 2. Hand Lever: Quarter-turn valves 6 NPS and smaller.
- D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
 - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: Extended neck.
 - 3. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
 - 5. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
 - 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Solder-joint Connections: ASME B16.18.
- G. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Bronze Valves:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRASS, BALL VALVES

- A. Three Piece, Full Port with Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 150 psig.
 - 3. CWP Rating: 600 psig.
 - 4. Body: Forged brass.
 - 5. Ends: Threaded.
 - 6. Seats: PTFE.
 - 7. Stem: Brass.
 - 8. Ball: Chrome-plated brass.

2.4 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. One Piece, Reduced Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 400 psig.
 - 3. CWP Rating: 600 psig.
 - 4. Body: Bronze.
 - 5. Ends: Press.
 - 6. Seats: PTFE.
- C. Three Piece, Full Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 150 psig.
 - 3. CWP Rating: 600 psig.
 - 4. Body: Bronze.
 - 5. Ends: Threaded or press.
 - 6. Seats: PTFE
 - 7. Stem: Stainless steel.
 - 8. Ball: Stainless steel, vented.

2.5 IRON, BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
 - 1. Comply with MSS SP-72.
 - 2. CWP Rating: 200 psig.
 - 3. Body: ASTM A536, Grade 65-45-12, ductile iron.
 - 4. Ends: Flanged.
 - 5. Seats: PTFE, TFE, or Teflon.
 - 6. Operator: Lever, with locking handle.

2.6 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style: Bi-directional dead-end service without use of downstream flange.
 - 1. Comply with MSS SP-67, Type I.
 - 2. CWP Rating: 200 psig.
 - 3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
 - 4. Stem: One or two-piece stainless steel.
 - 5. Seat: EPDM.
 - 6. Disc: Stainless steel.

2.7 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa).
 - 1. Comply with MSS SP-67, Type I.
 - 2. Body: Coated ductile iron.
 - 3. Stem: Two-piece stainless steel.
 - 4. Disc: Coated ductile iron.
 - 5. Disc Seal: EPDM.

2.8 BRONZE, SWING CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125: CWP Rating: 200 psig (1380 kPa).
 - 1. Comply with MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. Body: Bronze, ASTM B62.
 - 4. Ends: Threaded.
 - 5. Disc: Bronze.

2.9 IRON, HORIZONTAL SWING CHECK VALVES

- A. Class 125:
 - 1. Comply with MSS SP-71, Type I.
 - 2. CWP Rating: 200 psig.
 - 3. Design: Clear or full waterway.
 - 4. Body: ASTM A126, gray cast iron with bolted bonnet.
 - 5. Ends: Flanged.
 - 6. Trim: Composition.
 - 7. Seat Ring and Disc Holder: Bronze.
 - 8. Disc: PTFE or TFE.
 - 9. Gasket: Asbestos free.

2.10 IRON, GROOVED-END SWING CHECK VALVES

- A. 300 CWP:
 - 1. CWP Rating: 300 psig.
 - 2. Body: ASTM A536, Grade 65-45-12 ductile iron.
 - 3. Seal: EPDM.
 - 4. Disc: Ductile iron.
 - 5. Coating: Black, non-lead paint.

2.11 BRONZE, GLOBE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125: CWP Rating: 200 psig., and Class 150: CWP Rating: 300 psig.:
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
 - 3. Ends: Threaded joint.
 - 4. Stem: Bronze.
 - 5. Disc: PTFE or TFE.
 - 6. Packing: Asbestos free.
 - 7. Handwheel: Malleable Iron.

2.12 IRON, GLOBE VALVES

- A. Class 125: CWP Rating: 200 psig:.

1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 1. Lift Check: Install with stem plumb and vertical.
 2. Swing Check: Install horizontal maintaining hinge pin level.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

1.2 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- G. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2018.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- I. MFMA-4 - Metal Framing Standards Publication; 2004.
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 1. Product data.
 2. Test & inspection reports:
 3. O&M data
 4. Calculations:
 5. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals
 1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Low-Emitting Materials Submittals:
 - 1) EQ Credit Low Emitting Materials: General Emissions Evaluation.
Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite:
Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- D. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Comply with MSS SP-58.
 2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.

3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials (General Use):
1. Threaded rod: electro-plated steel, hot-dip galvanized steel, 304 stainless steel, or 316 stainless steel.
 2. Strut and fittings: hot-dip galvanized steel, 304 stainless steel, 316 stainless steel, or fiberglass.
 3. Auxiliary support materials: hot-dip galvanized steel, 304 stainless steel, or 316 stainless steel.
- C. Materials (Wet/Corrosive Areas):
1. These requirements shall apply to the following spaces:
 - a. Shower rooms
 2. Threaded rod: hot-dip galvanized steel or 316 stainless steel.
 3. Strut and fittings: hot-dip galvanized steel, 316 stainless steel, or fiberglass.
 4. Auxiliary support materials: hot-dip galvanized steel or 316 stainless steel.
- D. Materials (Outdoors):
1. Threaded rod: hot-dip galvanized steel or 316 stainless steel.
 2. Strut and fittings: hot-dip galvanized steel or 316 stainless steel.
 3. Auxiliary support materials: hot-dip galvanized steel or 316 stainless steel.
- E. Metal Channel (Strut) Framing Systems:
1. Manufacturers:
 - a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Comply with MFMA-4.
- F. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Manufacturers:
 - a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 2. Channel Material: Use polyester resin or vinyl ester resin.
 3. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
 4. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.
- G. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.

- c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
- H. Thermal Insulated Pipe Supports:
 - 1. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
- I. Pipe Supports:
 - 1. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 - 2. Operating Temperatures from 122 to 446 degrees F:
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
 - b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 Types 35 through 38.
- J. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
 - 1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 - 2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- K. Riser Clamps:
 - 1. Provide copper plated clamps for copper tubing support.
 - 2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
- L. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- M. Strut Clamps: Two-piece pipe clamp.
- N. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
- O. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
 - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 - 2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- P. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- Q. Pipe Shields for Insulated Piping:
 - 1. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
 - d. Minimum Service Temperature: Minus 40 degrees F.
 - e. Maximum Service Temperature: 178 degrees F.
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- R. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use materials approved for area of installation, per this specification.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
10. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- I. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

- J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.3 SUPPORT SPACING

- A. Cast iron (hubless) with shielded coupling joints
 - 1. Horizontal: Every other joint unless over 4', then support each joint.
 - a. Where 10' pipe sections are used, 10' horizontal spacing, support within 18" of each joint and at each horizontal branch connection. Brace at every 40' (maximum).
 - b. Hangers shall not be placed on the coupling.
 - 2. Vertical: Base and each floor, 15' maximum.
- B. Copper tube & pipe with soldered or brazed joints
 - 1. 1-1/2" and smaller:
 - a. Horizontal: 6'
 - b. Vertical: Each floor, 10' maximum.
 - 2. 2" and larger:
 - a. Horizontal: 10'
 - b. Vertical: Each floor, 10' maximum.
- C. Schedule 40 PVC DWV piping with solvent cemented joints
 - 1. Horizontal: 4'
 - a. Allow for expansion every 30'.
 - 2. Vertical: Base and each floor.
 - a. Provide mid-story guides.
 - b. Allow for expansion every 30'.
- D. Copper piping with mechanical joints
 - 1. 1" and smaller:
 - a. Horizontal: 6'
 - b. Vertical: 10'
 - 2. 1-1/4" to 2-1/2":
 - a. Horizontal: 10'
 - b. Vertical: 10'
 - 3. 3" and larger:
 - a. Horizontal: 10'
 - b. Vertical: 10'
- E. PEX-a piping, rigid:
 - 1. Horizontal: 5'
 - 2. Vertical: 10'
 - a. Provide mid-story guides.
- F. PEX-a piping, flexible:
 - 1. Horizontal: 4'
 - 2. Vertical: 4'
- G. PEX-b piping with metal insert and metal compression joints, rigid:
 - 1. Horizontal: 5'
 - 2. Vertical: 10'
 - a. Provide mid-story guides.
- H. PEX-b piping with metal insert and metal compression joints, flexible:
 - 1. Horizontal: 4'
 - 2. Vertical: 4'

- a. Provide mid-story guides.

3.4 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

3.5 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Self-regulating parallel resistance electric heating cable.
- B. Cable outer jacket markings.
- C. Connection kits.
- D. Accessories.
- E. Controls.

1.2 REFERENCE STANDARDS

- A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2012.
- B. ITS (DIR) - Directory of Listed Products; current edition.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.
- B. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.
- C. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.4 SUBMITTALS

- A. Field Quality Control Submittals: Indicate test reports and inspection reports.
- B. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- C. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - a. Final locations of all sections of heat trace, including service and approximate length.
 - b. Final locations of all controls.
 - c. Record of power connections (panel and circuit number) for each section of heat trace.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.

6. Training certificates.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 WARRANTY

- A. See Section 01 78 36 - Warranties.
- B. Provide two year manufacturer warranty for cables, connection kits, accessories, and controls.

PART 2 PRODUCTS

2.1 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

- A. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).
- B. Factory Rating and Testing: Comply with IEEE 515.1.
- C. Heating Element:
 1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
 2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
 3. Capable of crossing over itself without overheating.
- D. Insulated Jacket: Flame retardant polyolefin.
- E. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.
- F. Maximum Power-On Operating Temperature: 150 degrees F.
- G. Maximum Power-Off Exposure Temperature: 185 degrees F.
- H. Electrical Characteristics:
 1. 120 volts, single phase, 60 Hz.

2.2 CABLE OUTER JACKET MARKINGS

- A. Name of manufacturer, trademark, or other recognized symbol of identification.
- B. Catalog number, reference number, or model.
- C. Month and year of manufacture, date coding, applicable serial number, or equivalent.
- D. Agency listing or approval.

2.3 CONNECTION KITS

- A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.
- B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

2.4 ACCESSORIES

- A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
 - 1. High temperature, glass filament tape for attachment of heating cable to metal piping.
 - 2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
 - 3. Heat-conductive putty.
 - 4. Cable ties.
 - 5. Silicone end seals and splice kits.
 - 6. Installation clips.
 - 7. Warning labels for attachment to exterior of piping insulation. Refer to Section 22 05 53.

2.5 CONTROLS

- A. Pipe Mounted Thermostats:
 - 1. Remote bulb unit with adjustable temperature range from 30 to 50 degrees F.
 - 2. Control Enclosure: Corrosion resistant and waterproof.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping and equipment are ready to receive work.
- B. Verify required power is available, in proper location, and ready for use.

3.2 PREPARATION

- A. Clean exposed surfaces prior to installation.
- B. Prepare surfaces using approved methods as recommended by manufacturer.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's written installation instructions.
- B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.
- C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.
- D. Comply with applicable local building codes and requirements of authorities having jurisdiction.
- E. Grounding: Refer to Section 26 05 26.
- F. Identification:
 - 1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.
 - 2. Refer to Section 22 05 53.
- G. Electrical Connections: Refer to Section 26 05 19.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 15 00 - Contractor Quality Control.

- B. Perform start-up by factory technician or factory representative as per Owner's requirements.
- C. Field Testing and Inspections:
 - 1. Commission system in accordance with installation and operation manual.
 - 2. Inspect for sources of water entry and proper sealing.
 - 3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
 - 4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
 - 5. Test heating cable integrity with megohmmeter at the following intervals:
 - a. After cable has been installed onto the piping.
 - b. After the installation of thermal insulation onto the piping.
 - 6. Measure voltage and current at each unit.
 - 7. Controls:
 - a. Verify control parameters are set to the application requirements.
 - 8. Submit written test report showing values measured on each test for each cable.

3.5 CLOSEOUT ACTIVITIES

- A. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- B. Demonstrate operation of controls.

3.6 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.7 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration-isolated equipment support bases.
- B. External seismic snubber assemblies.
- C. Seismic restraint systems.

1.2 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Include the seal of the Professional Engineer registered in the State of Washington in which the Project is located, on drawings and calculations which at a minimum include the following:
- B. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- C. Required submittals:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 4. Project record documents.
 - 5. O&M data
 - 6. Calculations:
 - 7. Warranty information:
 - a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Perform design and installation in accordance with applicable codes.
- C. Designer Qualifications: Perform design of seismic controls under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

- D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General:
 - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
 - 2. Steel springs to function without undue stress or overloading.

2.2 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

- A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- B. Seismic Snubbing Elements:
 - 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Comply with:
 - 1. ASHRAE (HVACA) Handbook - HVAC Applications.
 - 2. SMACNA (SRM).
- D. All Directional External:
 - 1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
 - 2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
 - 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
 - 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- E. Lateral External:
 - 1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
 - 2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
 - 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
 - 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- F. Omni Directional External:
 - 1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.

2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- G. Horizontal Single Axis External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
 2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

2.3 SEISMIC RESTRAINT SYSTEMS

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Cable Restraints:
1. Comply with ASCE 19.
 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 4. Use protective thimbles for cable loops where potential for cable damage exists.
- C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.
- D. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
 2. SMACNA (SRM).
- E. Cable Restraints:
1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
 2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
 3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
 4. Connections:
 - a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
 - b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
 5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.
- F. Rigid Restraints:
1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
 2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
 3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.

4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

3.2 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- D. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
 1. Up to 4 Inches Pipe Size: First three points of support.

3.3 INSTALLATION - SEISMIC

- A. Comply with:
 1. ASHRAE (HVACA) Handbook - HVAC Applications.
 2. SMACNA (SRM).
- B. Seismic Snubbers:
 1. Provide on all isolated equipment, piping and ductwork.
 2. Provide minimum of four seismic snubbers located close to isolators.
 3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
 4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.
- C. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:
 1. Install equipment anchorage items designed to resist seismic design force in any direction.
 2. Install vibration and seismic controls designed to include base and isolator requirements.
 3. Where concrete floor thickness is less than required for expansion anchor installation, install through bolt in lieu of expansion anchor.
- D. Suspended Mechanical Equipment:
 1. Provide supports and bracing to resist seismic design force in any direction.
 2. Provide flexible connections between equipment and interconnected piping.
 3. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.

4. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.
- E. Wall mounted Mechanical Equipment:
 1. Provide support and bracing to resist seismic design force in any direction.
 2. Install backing plates or blocking as required to deliver load to primary wall framing members.
 3. Anchoring to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads is not permitted.
- F. Piping:
 1. Provide seismic bracing in accordance ASCE 7.
 2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
 3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.
 4. Brace resiliently supported pipe with cable bracing or alternate means designed to prevent transmission of vibrations and noise to the structure.
 5. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.
 6. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
 - a. Provide transverse bracing at spacing not more than 40.0 feet on center.
 - b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.
 7. Pipes and Connections Constructed of Non Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe):
 - a. Provide transverse bracing at spacing not more than 20.0 feet on center.
 - b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.
 8. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.
 9. Piping Explicitly Exempt from Seismic Bracing Requirements:
 - a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
 - b. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
 - c. Provide swing restraints as required to control potential impact due to limited space between subject components.
 10. Re-use of Existing Hangers:
 - a. Unless otherwise shown on drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.
- G. Tanks:
 1. Install tank anchorage, tank legs and/or supporting structure designed to resist design force.
 2. Provide flexible connections between tank and interconnected piping.

3.4 FIELD QUALITY CONTROL

- A. Inspect vibration isolation and/or seismic control components for damage and defects.
- B. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- C. Inspect isolated equipment after installation and submit report. Include static deflections.

3.5 SCHEDULES

- A. Pipe Isolation Schedule.
 - 1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
 - 2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
 - 3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.

3.6 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.7 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. O&M data
 - a. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
 - 3. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals
 - 1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Low-Emitting Materials Submittals:
 - 1) EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags. Key to control schematic.
- B. Control Panels: Nameplates.
- C. Heat Transfer Equipment: Nameplates.

- D. Instrumentation: Tags.
- E. Major Control Components: Nameplates.
- F. Piping: Pipe markers.
- G. Pumps: Nameplates.
- H. Small-sized Equipment: Tags.
- I. Tanks: Nameplates.
- J. Valves: Tags.

2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- D. Color Code:
 - 1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 07 16
PLUMBING EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Equipment insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Covering.

1.2 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- E. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2020.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. O&M data
 - 3. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals
 - 1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Materials and Resources Submittals:
 - 1) MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program,

recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- (a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible.
 - 1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- B. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - 1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 2. Secure with self-sealing longitudinal laps and butt strips.
 - 3. Secure with outward clinch expanding staples and vapor barrier mastic.

- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.
- E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.3 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

- A. Insulation: ASTM C553 Type V; flexible, noncombustible.
 - 1. Comply with ASTM C1695.
 - 2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 3. Minimum Service Temperature: 32 degrees F.
 - 4. Maximum Service Temperature: 500 degrees F.
 - 5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.

2.4 JACKETS

- A. PVC Plastic:
 - 1. Jacket: Sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 - 2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- G. For fiberglass insulated equipment containing fluids below ambient temperature, provide vapor barrier jackets, factory-applied or field-applied, and finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

- I. Fiberglass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- J. Inserts and Shields:
 - 1. Application: Equipment 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between hangers and inserts.
 - 3. Insert location: Between support shield and equipment and under the finish jacket.
 - 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- K. Finish insulation at supports, protrusions, and interruptions.
- L. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- M. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- N. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- O. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.

1.2 REFERENCE STANDARDS

- A. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- B. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. O&M data.
 - 3. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals
 - 1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Materials and Resources Submittals:
 - 1) MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 - LEED Certification Procedures.

- (a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. Maximum Service Temperature: 220 degrees F.
- B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.
- E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- F. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
- G. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

- H. Insulating Cement: ASTM C449.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 JACKETS

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 - 2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- J. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with PVC jacket with seams located on bottom side of horizontal piping.

3.3 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION – 22 08 00
COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this section is to specify the Division 22 responsibilities and participation in the commissioning process. See Division 1, Section 019100, "Commissioning," for Contractor-related commissioning requirements.
 - 1. Organization of the commissioning program is primarily the responsibility of the Commissioning Authority. Execution of the program is primarily the responsibility of the Contractor with support from the Division 22 Contractor for:
 - a. Testing and start-up of the mechanical equipment.
 - b. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 22 equipment and systems are fully operational and ready for functional testing.
 - c. Providing qualified personnel to assist the Commissioning Authority with functional testing to verify equipment/system performance.
 - d. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
 - e. Providing training for the systems specified in Division 22 with coordination of Owner by the Commissioning Authority.
- B. Division 22 Contractor shall cooperate with the Commissioning Authority in the following manner:
 - 1. Allow sufficient time before final completion dates so that test and balance, controls point-to-point checkout, and functional testing can be accomplished.
 - 2. Provide labor and material to make corrections when required without undue delay.
 - 3. Put all plumbing systems and equipment into full operation, and continue the operation of the same during each working day of commissioning.
- C. Related Sections
 - 1. Section 019100 – Commissioning
 - 2. Division 22 - Plumbing
 - 3. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
 - 4. Division 26 – Electrical

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Standard certified test equipment for commissioning will be provided by the Commissioning Authority.

- B. Proprietary test equipment required by the manufacturer shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

- A. Specific pre-commissioning responsibilities of Division 22 are as follows:
 - 1. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full-load and part-load performance, etc.
 - 2. Normal testing, adjusting and balancing services required to verify each system is operating at design capacities.
 - 3. Complete pre-functional test checklists for all equipment and systems to be commissioned
 - 4. Demonstrate system readings as requested by the Commissioning Authority and adjust units to achieve specified operation.
 - 5. Factory start-up services for key equipment and systems specified in Division 22. The Division 22 Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Division 22 Contractor shall provide skilled technicians to start-up and debug all systems within the Division 22 work (particularly with controls equipment). These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.
- C. Provide skilled technicians to manipulate the following equipment and systems to be commissioned for functional testing:
 - 1. Domestic water system

3.3 WORK TO RESOLVE DEFICIENCIES

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet Acceptable Performance. Correction of work will be completed under the direction of the Architect, with input from the Contractor, Equipment Supplier,

and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer-of-Record will have final jurisdiction on the necessary work to be done to achieve performance and/or design intent.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak loading, as well as part-load conditions. Initial commissioning will be done as soon as contract work is completed regardless of season. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.
- B. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.5 TRAINING

- A. The Division 22 Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.

END OF SECTION 22 08 00

SECTION 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Copper pipe and fittings.
- B. PEX pipe and fittings.
- C. PE pipe and fittings.

1.2 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- C. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- D. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- E. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2014.
- F. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.
- G. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.
- H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- J. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.
- K. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.
- L. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).
- M. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2012.
- N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- O. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction Materials; 2018.
- P. ASTM F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water-Pressure Piping Systems; 2015.
- Q. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2013a.
- R. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011.
- S. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2011.
- T. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe; 2010.
- U. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015.
- V. AWWA C651 - Disinfecting Water Mains; 2005.
- W. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

- X. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalog information. Indicate valve data and ratings.
- C. Project Record Documents:
 - 1. Record actual installed locations of piping, valves, and equipment.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of undocumented utilities.
- D. Operation and Maintenance Data: Provide product information and manufacturer's operation and maintenance information for all products used.
- E. Purging and Disinfecting Reports

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Buried piping shall comply with requirements of utility provider.
- C. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.
- D. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.
 - 1. Installers for PEX piping systems shall be factory trained by the PEX piping and fitting manufacturer.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.
- B. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located. Pothole and locate existing utilities prior to connection to existing utility. Locations shown on the plans have not been verified, and Contractor shall anticipate the actual location may differ from that shown. Service line serving the picnic area has not been field located.
- C. Verify that water-service piping may be installed to comply with original design and referenced standards.
- D. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Refer to Section 22 05 00 - Common Work Results for Plumbing for notification requirements for service interruptions.
 - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

3. Coordinate with utility provider for any interruption of existing water service.

1.7 COORDINATION

- A. Coordinate connection to water service with utility provider.

PART 2 PRODUCTS

2.1 COPPER PIPE AND FITTINGS

- A. Pipe: ASTM B88, Type-L.
- B. Fittings and flanges:
 1. Cast Bronze Fittings: ASME B16.15.
 2. Cast Copper Alloy Solder Joint Pressure Fittings: ASME B16.18.
 3. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings: ASME B16.22.
 4. Cast Copper Alloy Solder Joint Drainage Fittings (DWV): ASME B16.23.
 5. Cast Copper Alloy Fittings for Flared Copper Tubes: ASME B16.26.
 6. Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings: ASME B16.29.
- C. Alternate Fittings and Flanges:
 1. Rolled/grooved fittings.
 - a. Couplings: 200 PSI minimum joint working pressure, cast ductile iron housing conforming to ASTM A536. Gaskets for heating water or chilled water service, elastomer in accordance with ASTM D2000. Gaskets for domestic water service, EPDM per ASTM D2000. All grooved couplings shall be designed with angle bolt pads to provide rigid joint.
 - b. Flanges: 200 PSI minimum joint working pressure, cast ductile iron housing, suitable for bolting to ANSI Class-125 cast iron and 150 steel flanged components. Gasket material similar to coupling gasket material.
 2. Press fitting, Viega Rigid or Nibco Press System, conforming to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-ring for copper press fittings shall be EPDM.
- D. Solder: ASTM B32, lead free.

2.2 CROSS-LINKED POLYETHYLENE (PEX) PIPING

- A. PEX piping shall be PEX-a (Engel method) or PEX-b.
- B. PEX piping and fittings shall be of the same manufacturer.
- C. PEX-a piping systems shall use ASTM F1960 PEX expansion ring joint system. Fittings shall be engineered plastic, lead-free brass, lead-free bronze, or lead-free copper, of same manufacturer as piping and expansion ring system.
- D. PEX-b piping systems shall use press fittings of same manufacturer as piping. Press fittings shall be constructed from lead-free bronze or Radel R polymer with 304 stainless steel sleeves. Sleeve fittings shall incorporate view holes and a tool locator ring to ensure proper press connections.
- E. Pre-insulated PEX piping systems shall be allowed where both the piping and the pre-installed insulation systems meet or exceed the requirements of the drawings and specifications.
- F. Pipe installed underground shall be factory insulated.
- G. Fittings for transitions between PEX piping systems and other pipe materials and fitting systems shall be manufactured by the PEX piping and fitting manufacturer.

2.3 POLYETHYLENE (PE) PIPING

- A. SDR 9 conforming to AWWA, C901. Service lines shall be copper-tube size with a minimum pressure rating of 200 psi and standard dimension ratio not to exceed 9. Pipe shall be either black with blue striping or blue in color. Stainless steel stiffening inserts are required at all connection points.

PART 3 EXECUTION

3.1 GENERAL PIPING INSTALLATION

- A. General: Install per the Uniform Plumbing Code (UPC). Any UPC installation instructions located in Appendix "I" ("Installation Standards") for a specific piping material specified in this section applies to the work of this section.
- B. Preparation:
 - 1. Clean off scale and dirt inside and outside before assembly. Cut pipes and tubes square and ream to remove all burrs.
 - 2. Cut pipe accurately to field measurements so work can be placed without springing or forcing.
- C. Installation:
 - 1. Install so piping is free to expand, provide for all expansion with offsets or loops where necessary. Branch connections shall have three elbow spring pieces to allow for expansion.
 - 2. All changes in direction shall be made with fittings. All radius; shall be long radius.
 - 3. Arrange piping so as not to interfere with access or removal of other equipment or devices, block access to doors, windows, manholes or other access openings.
 - 4. Arrange piping to facilitate the removal of tube bundles, coils, etc. Provide unions ahead of screwed valves, traps or strainers on each side of each piece of equipment and wherever needed to dismantle piping.
 - 5. All piping shall be properly pitched and graded to drain moisture and/or vent air.
 - 6. Each low point shall have an accessible blind flange or screwed plug or cap.
 - 7. Route pipe to avoid liquid or air pockets throughout the work. Provide at high points of closed systems, collecting chambers and automatic air vents.
 - 8. Make reductions in pipe size using eccentric reducing fittings installed to provide drainage and venting.
 - 9. Nipples shall be of the same material as pipe. Close nipples shall not be used.
 - 10. Install pipe in neat and workmanlike manner, in accordance with best trade practice. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls unless otherwise shown. Where possible, group runs and rises.
 - 11. Install concealed pipes in walls with clearance around piping to prevent contact with structure.
 - 12. Pipes passing through concrete or masonry construction shall be fitted with sleeves. The inside diameter of pipe sleeves shall be at least 1/2 inch larger than the outside diameter of the pipe or pipe covering.
 - a. Refer to Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping for sleeve fabrication and installation instructions.
 - 13. At all connections between ferrous and non-ferrous pipe:
 - a. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
 - b. Large Bore Pipe: Provide dielectric flanges.

14. For site piping, ensure that minimum vertical clearances, as required by utility provider, are provided where crossing other utilities.
 15. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
 16. Do not use unions for underground piping.
- D. Installation, Building Service Connection
1. Install piping, connecting to existing building service line. Ensure that minimum vertical clearances, as required by utility provider, are provided where crossing other utilities.
 2. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.
 3. Piping Connections: Conforming to utility provider requirements.

3.2 APPLICATIONS

- A. Within Building Footprint:
1. Above-grade, exposed areas, domestic water CW, HW, TW, and HWC: Copper or PEX (rigid only)
 2. Above grade, concealed areas, domestic water CW, HW, TW, and HWC: Copper or PEX
 3. Below grade, domestic water CW, HW, TW, and HWC: PEX
 - a. Below grade PEX piping shall be installed without any buried fittings.
- B. Outside Building Footprint:
1. Below grade, domestic water CW: Copper, PEX, or PE

3.3 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 22 05 00 - Common Work Results for Plumbing.

3.4 COPPER PIPING INSTALLATION

- A. Copper Tube
1. Solder joints shall be made in accordance with the methods of ASTM B828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B812 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32. The joining of water supply piping shall be made with lead free solders and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2 % lead.
 2. Braze all below ground copper tube joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.
- B. Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- C. Rolled/Grooved Connections: Install in accordance with manufacturer's instructions.
- D. Flared Joints: Flared joints for water pipe; shall be made by a tool designed for that operation.

3.5 PEX PIPE INSTALLATION

- A. Piping shall be installed per the Installation Standard for PEX Tubing Systems for Hot- and Cold-Water Distribution (IAPMO IS 31), published by the International Association of Plumbing and Mechanical Officials.
- B. The Contractor shall demonstrate proficiency in making fitting connections to the satisfaction of the manufacturer's representative. The Contractor shall follow strictly the manufacturer's published instructions covering the recommended procedures for installing PEX piping systems, including handling and storage of piping and fittings.
- C. Install piping per pipe manufacturer's recommendations.
- D. Do not cut threads into plastic pipe. Use separately purchased thread adapters. Install nipples on metallic valves.
- E. PEX piping in exposed areas shall be rigid tube type, with fittings used for all direction changes.
- F. PEX piping in concealed areas may be coiled or rigid type.
- G. PEX piping installed underground shall be run continuous without any fittings. All PEX fittings shall be located above grade.
- H. Provide rigid copper pipe fitting stubs for connections to plumbing fixtures and stops. Pipe fitting stubs shall be rigidly fixed to building structure.
- I. PEX-a Piping Systems
 - 1. Joints in PEX-a piping systems with expansion ring fittings shall be made per ASTM F1960 requirements. Joints shall be made using pipe and fitting manufacturer's approved installation tools.
 - 2. Installation shall be performed in accordance with the pipe and fitting manufacturer's most recent installation guidelines.
- J. PEX-b Piping Systems
 - 1. Joints in PEX-b piping systems with press fit joints shall be made using pipe and fitting manufacturer's approved ratcheted press tools.
 - 2. Installation shall be performed in accordance with the pipe and fitting manufacturer's most recent installation guidelines.

3.6 PE PIPING INSTALLATION

- A. General
 - 1. Install PE pipe according to ASTM D 2774 and ASTM F 645.
 - 2. Bury piping with depth of cover over top at least 36 inches.
 - 3. Extend water-service piping from connection point to existing water service line connect to building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - a. Terminate water-service piping at 5 feet from building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- B. Joint Construction
 - 1. Make pipe joints according to the following:
 - a. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 - b. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- C. Connections
 - 1. Piping installation requirements: Conform to utility provider requirements.

2. Connect water-distribution piping at downstream end of meters.
3. Connect water-distribution piping to interior domestic water piping.
- D. Field Quality Control
 1. Piping Tests: Conform to utility provider requirements.
 2. Hydrostatic Tests: Conform to utility provider requirements.
 3. Prepare reports of testing activities.
 4. Conform to utility provider requirements for service connections.
- E. Identification
 1. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate 6 to 8 inches below finished grade, directly over piping. Underground warning tapes are specified in Section 31 2000 - Earth Moving.
- F. Cleaning
 1. Conform to utility provider requirements.

3.7 FIELD QUALITY CONTROL

- A. Inspect water distribution piping:
 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the appropriate authority having jurisdiction.
 2. During progress of the installation, notify the plumbing official having jurisdiction at least two (2) working days prior to the time inspection must be made. Perform tests specified below in the presence of the Plumbing Inspector.
 - a. Ground work Inspection: Arrange for inspection of all plumbing systems located beneath any poured concrete slabs or foundations.
 - b. Roughing-In Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.
 - c. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
 3. Re-inspections: When a Plumbing Inspector finds that piping system will not pass test or inspection, make required corrections and arrange for re-inspection by the Plumbing Inspector.
 4. Reports: Prepare and submit inspection reports signed by the Plumbing Inspector.
- B. Testing water distribution system:
 1. Test for leaks and defects in new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
 2. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.
 3. Cap and subject the piping system to a static water pressure of 50 psi above the operating pressure without exceeding pressure rating of piping system materials. Isolate test-source and allow it to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.8 CLEANING:

- A. Clean and disinfect water distribution piping:
 1. Purge new potable water distribution piping systems and parts of existing potable water systems that have been altered, extended, or repaired prior to use.

2. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if a method is not prescribed by that authority, the procedure described in either AWWA C651 or AQA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill system or part thereof with water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) and allow it to stand for 24 hours.
 - c. Drain system or part thereof of previous solution and refill with water/chlorine solution containing at least 200 parts per million of chlorine. Isolate and allow it to stand for 3 hours.
 - d. Flush system with clean, potable water until chlorine does not remain in water coming from system following allowed standing time.
 - e. Submit water samples in sterile bottles to authority having jurisdiction. Repeat procedure if biological examination made by authority shows evidence of contamination.
- B. Prepare and submit reports for purging and disinfecting activities.
- C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.9 COMMISSIONING

- A. Fill water systems.
- B. Before operating systems, perform these steps:
 1. Close drain valves, hydrants, and hose bibs.
 2. Open shutoff valves to full open position.
 3. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
 4. Check plumbing equipment and verify proper settings, adjustments, and operation.
 5. Do not operate water heaters before filling with water.
 6. Check plumbing specialties and verify proper settings, adjustments, and operation.
 7. Energize pumps and verify proper operation.

3.10 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.11 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Expansion Tanks
- B. Strainers
- C. Trap Primers
- D. Dielectric Connections
- E. Automatic Air Vents
- F. Water Hammer Arrestors
- G. Pressure Reducing Valves
- H. Backflow Preventers
- I. Thermostatic Mixing Valve Assemblies
- J. Water Meters
- K. Wall Hydrants

1.2 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI)
 - 1. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment
- B. American Society of Mechanical Engineers (ASME)
 - 1. Section VIII - Pressure Vessels
- C. American Society of Sanitary Engineers (ASSE)
 - 1. ASSE 1013 - Reduced Pressure Principle Backflow Preventers
 - 2. ASSE 1020 - Vacuum Breakers, Anti-Siphon, Pressure Type
- D. American Water Works Association (AWWA)
 - 1. AWWA C701 - Standard for Cold-Water Meters, Turbine Type
- E. International Association of Plumbing and Mechanical Officials (IAPMO)
 - 1. Uniform Plumbing Code (UPC)
- F. National Safety Foundation (NSF)
 - 1. NSF 61 - Drinking Water System Components

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required Submittals:
 - 1. Product data.
 - 2. Test and Inspection Reports:
 - a. Completed manufacturer's startup checklist and report.
 - b. Commissioning report.
 - 3. Project record documents.
 - 4. Operation and maintenance data.

5. Warranty information:
 - a. Manufacturer's warranty.
 - b. Manufacturer's extended warranty.
6. Training certificates.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.5 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for closeout submittal procedures.
- B. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

- A. Provide diaphragm or bladder type expansion tank for hot water systems as shown on plans.
- B. Maximum working pressure rating shall be minimum of 125 PSIG.
- C. Expansion tank construction shall be ASME rated.
- D. Expansion tank shall be suitable for use with potable water systems.

2.2 STRAINERS

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Water: Strainers shall be wye-type with easily removable cover and brass strainer basket.
- C. Body:
 1. 1/2 - 2-1/2 NPS: Brass or bronze.
 2. 3 NPS and Larger: Cast iron, semi-steel, brass, or bronze.
- D. Accessories:
 1. Provide blowdown valves for strainers. Blowdown valves shall be ball valves with 3/4 inch hose connection and thread-on hose cap.

2.3 TRAP PRIMERS

- A. J.R. Smith, PPP Inc., or equal.

2.4 DIELECTRIC CONNECTIONS

- A. Union Type
- B. Flange Type

2.5 AUTOMATIC AIR VENTS:

- A. Float type with isolating valves, brass or semi-steel body, copper float, stainless steel valve and valve seat. Suitable for system operating temperature and pressure, but not less than 80 PSIG.

2.6 WATER HAMMER ARRESTORS

- A. Stainless steel shell and bellows, nitrogen pressurized compression chamber, Jay R. Smith Hydrotrol or approved equal.

2.7 PRESSURE REDUCING VALVES

- A. Single-seated, for dead end service for 30lb to 125lb range on low-pressure side. Composition diaphragm and stainless steel springs, bronze body with threaded connections for sizes 1/2 - 2 NPS, cast iron or semi-steel body with brass or bronze trimmings and flanged connections for sizes 2-1/2 - 4 NPS.
- B. Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than 1lb for each 10lb variation on inlet pressure.
- C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- D. Connections at Valves And Strainers: Install shut off valve on each side of reducing valve and full sized bypass with shut off valve. Install strainer on inlet side of, and same size as pressure reducing valve. Install pressure gauge on low pressure side of line.

2.8 BACKFLOW PREVENTERS

- A. Install backflow preventers per the requirements of the Uniform Plumbing Code; Article 603 "Cross Connection Control". All backflow preventers shall be listed by the State of Washington, Department of Health, as an approved cross-connection control device.
- B. Pressure Type: ASSE 1020
- C. Double Check Valve Assemblies, Reduced Pressure, 1 - 3 NPS
 - 1. Bronze body construction.
 - 2. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs.
 - 3. Seats and seat discs shall be replaceable in both check modules and the relief valve.
 - 4. There shall be no threads or screws in the waterway exposed to line fluids.
 - 5. Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts.
 - 6. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4.
 - 7. Provide with the following accessories:
 - a. Four resilient seated test cocks.
 - b. Two resilient seated quarter turn ball valves for isolation.
 - c. Bronze strainer at inlet.
 - d. Airgap fitting for relief discharge.

2.9 THERMOSTATIC MIXING VALVE ASSEMBLIES

- A. Point Of Use Mixing Valves
 - 1. Point-of-use thermostatic tempering valve with lead-free brass, bronze, and stainless steel construction. Valve shall be pressure tested to 125 PSI. Valve shall have tamper resistant temperature control handle and protective cap.

2.10 WATER METERS

- A. Positive Displacement Type
 - 1. Meters shall be constructed to meet or exceed ANSI and AWWA C701 standards, and shall be certified to meet NSF/ANSI Standard 61.
 - 2. Meter body shall be lead-free bronze alloy, with flanged piping connections.
- B. Accessories
 - 1. Provide digital encoder for each water meter. Encoder shall have digital output suitable for connections to building DDC system.

2.11 WALL HYDRANTS

- A. Freezeproof
 - 1. Box type with integral vacuum breaker.

PART 3 EXECUTION

3.1 EXPANSION TANKS

- A. Expansion tank shall be located on cold water supply line adjacent to water heater.
- B. Where a backflow prevention or check valve is provided, locate between that device and the water heater.
- C. Tanks shall be suitable for use in potable water systems, and be pre-charged to 55 PSIG. Relief valve of water heater to be set at 125 PSIG.

3.2 STRAINERS

- A. Provide blowdown valves with 3/4 inch hose connections at all strainer locations.

3.3 DIELECTRIC CONNECTIONS

- A. Provide dielectric connections at all connections between ferrous and non-ferrous pipe:
 - 1. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation.
 - 2. Large Bore Pipe: Provide dielectric flanges.

3.4 AUTOMATIC AIR VENTS

- A. Locate automatic air vents at high points in piping system.
- B. Where air vents are located in inaccessible locations, covered locations, or in locations where leakage could potentially damage the building in any way, provide drain piping from the air vent to the nearest approved indirect drain receptor.
 - 1. Drain piping shall not be run to drain locations in public areas.

3.5 WATER HAMMER ARRESTORS

- A. Provide water hammer arrestors at all of the following location(s):
 - 1. All restroom piping groups.
 - 2. Water header assembly.

- B. Size and provide in accordance with the Manufacturer's Instructions.

3.6 PRESSURE REDUCING VALVES

- A. Set discharge pressure of pressure reducing valves as follows:
 - 1. General use: 60-80 psig

3.7 BACKFLOW PREVENTERS

- A. Provide isolation valves and strainers for all backflow preventer assemblies.
- B. Route discharge pipe from pressure-reducing type backflow preventer assemblies from air gap fitting at assembly to the nearest floor drain, floor sink, or other approved drain location.
 - 1. Pipe shall not be routed across floor or in other manner that creates a tripping hazard or otherwise obstructs the area.

3.8 THERMOSTATIC MIXING VALVE ASSEMBLIES

- A. General
 - 1. Install temperature-actuated water mixing valves with check stops and shutoff valves on inlets and with shutoff valve on outlet.
- B. Labelling
 - 1. Provide explanatory text on signs. Identify units. Distinguish among units, inform operator of operating requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Setup, Testing and Adjusting
 - 1. Startup of mixing valve assemblies shall be performed by factory-trained technicians. Perform startup of valve system in accordance with manufacturer's instructions.
 - 2. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.
 - 3. Remove and replace malfunctioning thermostatic mixing valves and retest.

3.9 TRAP PRIMERS

- A. Provide trap primers and primer connections for all of the following:
 - 1. Floor drains.
 - 2. Floor sinks.
 - 3. Trench drains.

3.10 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.11 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast iron piping.
- B. Plastic piping.
 - 1. PVC piping.

1.2 REFERENCE STANDARDS

- A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
- B. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- C. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- D. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- E. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- F. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
- G. CSA CAN/CSA B602M - Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe.
- H. IAPMO IS 1 - Non-Metallic Building Sewers
- I. IAPMO IS 9 - PVC Building Drain, Waste and Vent Pipe and Fittings
- J. UPC - Uniform Plumbing Code

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. Test and Inspection Reports:
 - 3. Project record documents.
 - 4. Operation and maintenance data.
 - 5. Warranty information:
 - a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Buried piping shall comply with requirements of utility provider.
- C. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.

- D. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.6 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training.

PART 2 PRODUCTS

2.1 CAST IRON PIPE AND FITTINGS

- A. Soil, Drain, Waste, and Vent Piping: Standard weight bell and spigot cast iron (ASTM A74) or hubless cast iron (ASTM A888/CISPI 301).
- B. Bell and Spigot Fittings: ASTM A74 with ASTM C564 compression gaskets.
- C. Hubless Fittings: ASTM A888 or CISPI 301.
 - 1. Couplings: CISPI 301, ASTM C1277, or ASTM C1540.
 - 2. Elastomeric Sealing Sleeve: ASTM C564, CISPI HSN 85, or CSA CAN/CSA B602M, with center stop.

2.2 PLASTIC PIPE AND FITTINGS

- A. All material references are found in the International Association of Plumbing and Mechanical Officials (IAPMO) "Uniform Plumbing Code" (UPC), all references are those in force by the Authority Having Jurisdiction at the date of bid.
- B. Building Drainage, Waste and Vent:
 - 1. Materials for Poly-Vinyl-Chloride (PVC) Plastic drain, waste and vent pipe and fittings shall be as specified in IAPMO Installation Standard (IS) 9, "PVC Building Drain, Waste and Vent Pipe and Fittings".
 - a. PVC pipe and fittings shall be schedule 40 PVC, conforming to ASTM D-2665, with glued fittings. Pipe shall be solid wall.

PART 3 EXECUTION

3.1 GENERAL

- A. All main vertical soil and waste stacks shall be installed with provision for expansion and shall be extended full-size to and above roof lines as vents, except where otherwise specifically indicated.
- B. All vent pipe openings on the roof shall terminate not less than 10 feet horizontally and 1 foot vertically above any opening to the building or outside air intake opening.
- C. Where practical, two or more vent pipes shall be connected together and extended as one pipe through roof. Vent pipes in roof spaces shall be run as close as possible to underside of roof,

with horizontal piping pitched down to stacks without forming traps in pipes, using fittings as required.

- D. Vertical vent pipes may be connected into one main riser above vented fixture. Where an end or circuit vent pipe from fixture or line of fixtures is connected to a vent line serving other fixtures, connections shall be located to prevent use of any vent line as a waste.

3.2 APPLICATIONS

- A. Within Building Footprint:
 - 1. Below grade, sanitary sewer, general use: Cast iron or PVC
 - 2. Below grade, vent, general use: Cast iron or PVC
 - 3. Below grade, sanitary sewer, grease service: Cast iron
 - 4. Above grade, sanitary sewer, general use: Cast iron
 - 5. Above grade, vent, general use: Cast iron
- B. Outside Building Footprint:
 - 1. Below grade, sanitary sewer, general use: Cast iron or PVC
 - 2. Below grade, sanitary sewer, grease service: Cast iron

3.3 CAST IRON PIPE INSTALLATION

- A. Hub and Spigot Compression Gasket: Conform to manufacturer's instructions. Gaskets shall be compressed with the pipe is fully inserted.
- B. Mechanical Joints for Hubless Cast Iron: Install in accordance with manufacturer's instructions and CISPI standards (except for acid-resistant piping).
- C. Where cast iron piping is used in above-grade applications in combination with plastic piping below grade, the cast iron piping shall extend a minimum of 18 inches below grade or to the first fitting below grade, whichever is deeper.

3.4 PLASTIC PIPING INSTALLATION

- A. PVC Building DWV: Install per the installation standard for Non-Metallic Building Sewers (IAPMO IS 1), and the installation standard for PVC Building Drain, Waste and Vent Pipe and Fittings (IAPMO IS 9) as published by the International Association of Plumbing and Mechanical Officials and found in the Uniform Plumbing Code Manual.

3.5 PIPE SLOPE

- A. Horizontal drain piping shall be installed with the following minimum pipe slope(s):
 - 1. Up to 3-1/2 NPS: 1/4 inch per foot (2%).
 - 2. 4 NPS and Larger: 1/8 inch per foot (1%).

3.6 ROOF PENETRATIONS

- A. Provide manufactured neoprene, santoprene, or similar vent flashing assemblies for all roof penetrations.
- B. Vent flashing assemblies shall be compatible with the roof construction where the penetration is located.

3.7 CLEANOUTS

- A. Provide cleanouts as specified in Section 22 13 19 - Sanitary Waste Piping Specialties.

3.8 TESTS

- A. Sanitary and waste lines shall be tested with water at a pressure of not less than 5 PSI. Duration of test shall be not less than 24-hours, and shall be witnessed by Architect.
- B. If any piping is found to leak, all defects shall be remedied and test repeated.

3.9 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.10 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flexible pipe joints
- B. Drains
- C. Cleanouts

1.2 REFERENCE STANDARDS

- A. American Society of Sanitary Engineers (ASSE)
 - 1. ASSE 1051 - Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems
- B. American Society of Testing and Materials (ASTM)
 - 1. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials
- C. International Association of Plumbing and Mechanical Officials
 - 1. UPC - Uniform Plumbing Code
- D. National Sanitation Foundation International (NSF)
 - 1. NSF 14 - Plastics Piping System Components and Related Materials

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. Project record documents.
 - 3. O&M data.
 - 4. Warranty information:
 - a. Manufacturer's warranty.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.5 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE JOINTS

- A. Expansion Joints: Waste/Vent/Storm Drain Stacks: JR Smith Model 1710 or approved equal.
- B. Flexible Pipe Joints: Waste/Vent/Storm Drain: Metraflex Model 201 or approved equal.

2.2 DRAINS

- A. Drains shall be Josam, Jay R. Smith, Sioux Chief, Wade, Zurn, or approved equal.
- B. Floor Drains
 - 1. FD-1 Floor Drains: Duco cast iron body with flashing collar, square polished nickel bronze adjustable strainer head and grate, trap primer connection and vandal proof screws.
 - 2. FD-3 Floor Drains: Duco cast iron body with flashing collar, square polished nickel bronze adjustable strainer head and grate, trap primer connection and vandal proof screws.
 - 3. FD-2 Floor And Funnel Drains: Duco cast iron two piece body with flashing collar, seepage openings, round polished nickel bronze adjustable strainer head and grate complete with 4 inch diameter polished nickel bronze funnel, trap primer connection and vandal proof screws.
- C. Floor Sinks
 - 1. FS-1 Floor Sinks: Stainless steel flanged receptor fabricated of 304 stainless steel with half grate stainless steel top, sediment bucket and flashing clamp.

2.3 CLEANOUTS

- A. Cleanouts shall be Josam, Jay R. Smith, Sioux Chief, Wade, Zurn, or approved equal.
- B. Floor: Duco cast iron body with round adjustable scoriated secured nickel bronze top, gasket seal-ABS countersunk closure plug, complete with flashing flange and clamp.
- C. Wall: Duco cast iron caulk ferrule with cast iron countersunk closure plug. Provide with stainless steel cover and screw.

PART 3 EXECUTION

3.1 GENERAL

- A. Install specialties in accordance with Uniform Plumbing Code, Manufacturer's installation instructions, and local jurisdiction requirements.

3.2 DRAINS

- A. Provide the drainage equipment and all piping for a complete drainage system as shown and detailed on Plans.
- B. Install floor sinks with the top of the fixture as sufficient distance above finish floor elevation to prevent floor drainage from entering the floor sink. Floor sinks in kitchen areas shall be installed completely under counters to avoid trip hazard.
- C. Provide water pipe connections to trap primers and run the primer lines to the drains. Verify location of trap primers with Architect before installing.

- D. See Section 22 11 19, Domestic Water Piping Specialties, for trap primers.

3.3 CLEANOUTS

- A. Provide cleanouts as indicated on the plans, and as required by the Uniform Plumbing Code.
- B. Provide cleanouts at the locations specified below, regardless of whether or not indicated on the drawings:
 - 1. Drains Within Buildings: Not more than 100' apart.
 - 2. Drains Outside Of Buildings: Not more than 100' apart.
 - 3. Changes of Direction Inside Buildings: At each fitting of greater than 45 degrees. Where more than one change of direction occurs in a run of piping, only one cleanout shall be required for each 40' of developed length of the drainage piping.
 - 4. Building Sewer Junction: Provide a cleanout at the junction between the building drain and building exterior sewer. Provide a 2-way cleanout at this junction.
- C. Install in accordance with Manufacturer's instructions.

3.4 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 221453 - RAINWATER HARVESTING AND WATER STORAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rainwater Harvesting System Including the Following:
 - 1. Rainwater pre-filters.
 - 2. Storage tanks.
 - 3. Distribution pumps.
 - 4. Accessories.

1.2 RELATED SECTIONS

- A. Division 2 - Site Construction.
- B. Division 15 - Mechanical.
- C. Section 221400 - Facility Storm Drainage.

1.3 REFERENCES

- A. International Organization for Standardization (ISO):
 - 1. ISO 9001 - Quality management systems - Requirements.
- B. Underwriters Laboratories (UL):
 - 1. UL 508 - Standard for Industrial Control Equipment.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: For system components; include dimensions, capacities, operating characteristics, utility connections, and accessories.
- C. Shop Drawings:
 - 1. For Rainwater Harvesting Systems: Include system layout, components, and accessories.
- D. Closeout Submittals: Operation and maintenance data.
 - 1. Provide instructions on operation, calibration, troubleshooting, and servicing equipment.
 - 2. Include layout drawings, parts lists, and component manufacturer's product data.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data:
 - 1. Manufacturer's data sheets on each product to be used.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Typical installation methods.
- C. Verification Samples: Two representative units of each type, size, pattern, and color.

- D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Minimum 10 years' experience in work of this Section.
 - 2. Successful completion of minimum of 10 previous projects of similar scope and complexity.
- B. Installer Qualifications:
 - 1. Successful completion of 3 previous projects of similar scope and complexity.
 - 2. Minimum 3 years' experience in work of this Section.

1.7 PRE-INSTALLATION CONFERENCE

- A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Landscape Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver system components until time needed for installation, and after proper protection can be provided.
- B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- C. Protect from damage due to weather, excessive temperature, and construction operations.
- D. Leave protective coverings in place until just prior to installation.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bushman USA, which is located at: 26040 Ynez Road · P.O. Box 9022 · Temecula, CA 92589; Tel: 1-866-920-8265; Web: bushmanusa.com
 - 1. Acceptable Manufacturers for Storage Tanks:
 - a. Bushmann, or approved equal.
 - 2. Acceptable Manufacturers for Pumps and Pump Skids:
 - a. Bushmann, or approved equal.
 - 3. Acceptable Manufacturers for Controls and Float Switches:
 - a. Bushmann, or approved equal.
 - 4. Acceptable Manufacturers for Rainwater Filters, Storage Tank Accessories, and Purification Kits:
 - a. Bushmann, or approved equal.

- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 RAINWATER HARVESTING SYSTEMS

A. Rainwater Harvesting Systems:

1. System Description: Custom rainwater harvesting system consisting of manufactured components. The system shall collect rainwater from the roof and convey rainwater through roof drains, downspouts and conveyance piping, self-cleaning, gravity fed pre-filters. Filtered rainwater will travel through the pre-filter and into a rainwater storage tank. Water will be drawn out of the storage tank and pumped through a packaged pumping system to the irrigation/plumbing system. The pumping system will be designed to provide water at the desired design point on an on-demand basis.
2. Design Requirements: Filter, store, and distribute harvested rainwater.
3. Water Disinfection Methods: May include sediment filtration, carbon filtration, or a combination thereof.
4. Hydrostatically test prefabricated pump assembly in factory prior to shipment to Project site.

B. Components:

1. Rainwater Pre-filters: Gravity-fed self-cleaning.
2. Rainwater Storage Tanks:
 - a. Bushman Above Ground Round Water Storage Tank of 420 Gallon
 - 1) Model number: BM-BRTT-420
 - 2) Capacity: 420 Gallons
 - 3) Color: Dark Brown (N-45711)
 - 4) Size 47" Dia. x 64" Ht.
 - 5) Weight 165 lbs.
 - 6) Tank to include: 16" inlet strainer and cover.
 - a) Two (2) 1" lower threaded outlet fittings
 - b) One (1) 3" overflow assembly
 - c) One (1) 3" accessory port
 - 7) Lid Size: 16"
 - 8) Overflow: 3"
 - 9) Accessory Port: 3"
 - 10) Outlet Fittings 1"
3. Pump Systems:
 - a. Bushman Rainwater Harvesting 1 HP Pump Kit
 - 1) Model number: BPK1225C-KP1A01
4. Accessories:
 - a. Bulkhead Fittings: Sized to match system inlet, outlet, pump flow rate, vents, and other penetrations.
 - b. Vent Assembly: PVC rodent-proof cap for tank air and vacuum relief; extend

from top of tank to above grade.

- c. Rain Harvesting Tank Gauge – Tank Level Monitor

- 1) Model number: RH-TATG02

- d. Waterproof Electrical Connection Box: Located on building wall, field installed.

2.3 DISPURSEMENT SYSTEM

A. GARDEN HOSE SPIGOT

- 1. Lee Valley Stainless-Steel Hose Hanger

- a. Model Number: XB808

- b. Dimensions: 10" wide, 4 ½" deep and 9 ¼" high.

- c. Acceptable manufacturers include, but are not limited to, the following:

- Lee Valley & Vetitas

- Phone: 1-800-871-8158

- Email: customerservice@leevalley.com

- Website: www.leevalley.com

- 2. Accessible Hose Bibb: Description: 3/4" MIP Pro-Series Forged Brass 1/4 Turn Ball Valve Hose Bibb Stainless Steel Handle.

- a. Brand: Wolverine Brass

- b. Model: 54239

- c. Handle Included: Yes

- d. Type: 1/4 Turn

- e. Series: ProSeries

- f. Connection Type: MIP

- g. Handle Type: E-Z Turn Lever

- h. Nominal Size: 3/4" x 3/4"

- i. Material: Heavy Forged Brass, Stainless Steel Handle

- j. Acceptable manufacturers include, but are not limited to, the following:

- PlumbMaster

- 2951 E Hwy 501

- Conway, SC 29526

- 1-800-523-5130

- Website: plumbmaster.com

1.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.

- B. Do not proceed with installation until substrates have been prepared using the methods

recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.
- B. Arrange equipment so that components requiring removal or maintenance are readily accessible without disturbing other components. Arrange for clear passage between components.
- C. Connect to utility supplies and equipment.
- D. Do not bury components deeper than manufacturer's recommended depth or in a manner that would exceed engineering loads.

3.3 FIELD QUALITY CONTROL

- A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
- B. System Integrators:
 - 1. Installation oversight and technical support.
 - 2. Terminate and test control system wiring and operation of electrical components.
 - 3. Demonstrate proper pump and controls operation.
 - 4. Make adjustments to meet user-defined system performance.
 - 5. Review operation and maintenance procedures with Owner's representative.

3.4 CLEANING AND PROTECTION

- A. Clean and protect products in accordance with the manufacturer's recommendations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 22 31 23
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hot water circulating pumps.
- B. Domestic water pressure booster system.

1.2 REFERENCE STANDARDS

- A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.
- B. National Electrical Manufacturers Association (NEMA)
 - 1. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
 - 2. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
 - 3. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. U.S. Food and Drug Administration
- D. American Society of Mechanical Engineers (ASME)
 - 1. Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division I and II.
- E. Underwriters' Laboratories, Inc. (UL)
 - 1. Safety Industrial Control Equipment

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Manufacturers: A company specializing in manufacturing products specified in this section with a minimum of three years documented experience.
- C. Installers: The installer shall have a minimum of five continuous years' experience installing systems specified in this section and at least ten projects of similar size and scope.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.6 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 GENERAL CIRCULATING PUMP

- A. Configuration: Inline
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Accessories:
 - 1. Aquastat
 - 2. Motor rated wall switch

2.2 DOMESTIC WATER PRESSURE BOOSTER SYSTEM

- A. General: Provide a factory prefabricated, pre-wired and pre-tested multi-pump system including three constant speed pumps, pressure regulating valves with integral check valves, vibration pads, emergency switches, duplex flow switches, pressure switches, power and control panels, suction and discharge manifolds, and gate valves and accessories. All components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer. All components shall be factory installed on a common structural steel skid and shall be completely tested in the factory before shipment.
- B. System Operation: System shall automatically maintain constant system pressure 75 PSI at the outlet of the pressure control valve and hydropneumatic tank check valve at all times. Suction pressure varies from 50 PSI to 60 PSI. The smaller pump will run constantly until the water demand exceeds the capacity of the pump, at which point the three system pumps will be operated sequentially to maintain system requirements. Lead lag switches for pump selections shall be incorporated into the control system. The system shall be controlled by a combination of flow or pressure switches and pressure regulation valves, and shall be designed to prevent water hammer. Pumps shall be free of cavitation over their operating range. Emergency controls with audible alarms shall insure constant system pressure at all times.
- C. Vertical Turbine Pump: Pumps shall be vertical multistage short coupled industrial turbine pumps.
 - 1. Impellers: Cast bronze, mixed flow enclosed type.
 - 2. Balancing Of Impellers: Each impeller shall be statically and dynamically balanced prior to assembly in pump casing.
 - 3. Pump Shaft: Stainless steel Type-416.

4. Lubrication: Water lubricated type pump.
 5. Pump Bowls: Cast Iron, flanged and bolted.
 6. Pump Bearings: Bronze, radial type.
 7. Pump Head: Fabricated steel with continuous bypass for low seal pressure. Cast iron heads are not acceptable. Pump head shall be lined same as pump barrel.
 8. Seal: Mechanical general purpose type, with sleeve mounting. Seal shall be rated at 1200 kPa (175 PSI) maximum.
 9. Adjustable Spacer Coupling: Removable type required so that pump seal can be replaced without disturbing motor.
 10. Motor: Solid shaft motors balanced to .22mm (0.0085") vibration amplitude shall be operated at any point on the pump head curve without overloading the motor. Conform to NEMA 250 Type-2.
 11. Pump Barrel: Schedule 40, steel pipe with two-coat "baked" internal lining to meet the potable water requirements of U.S. Food and Drug Administration. Unlined pump barrels are not acceptable. Provide drain tapping.
- D. Pressure Regulating Valves: System pressure shall be maintained by pilot operated, diaphragm type pressure regulating valves, rated at 300 PSI minimum, one for each pump. Valves shall be piloted to control system pressure and to cause the valve to act as a non-slam check valve. Pilot shall be rated at 175 PSI minimum.
- E. Hydropneumatic Tank: Bladder type, hydropneumatic, designed and constructed in accordance with requirements of the ASME Pressure Vessel Code and stamped with appropriate symbol. Tank shall include pre-pressurized, sealed-in air cushion, which shall accommodate pressure increases and expanded water volumes in the tank. Tank shall include butyl rubber, polypropylene, or equal liner in lower, or water side of chamber. Minimum working pressure of tank shall be 175 PSI. Unit suitable for domestic water applications. Insulate tank as specified. Check valve at hydropneumatic tank shall include small orifice for undue loading.
- F. Power And Control Panel: Class-A shadow box double NEMA 1 enclosure, UL labeled, bonderized double prime coated with baked enamel finish:
1. Fused disconnect switches with external operating handles.
 2. Magnetic contactor for each motor with H.O.A. switch.
 3. Door interlock.
 4. Thermal overload protection relay for each motor, three leg type.
 5. Running light for each motor.
 6. Power light for each motor.
 7. Minimum run timers to prevent short cycle operation.
 8. Control transformer, switch, circuit breaker, light.
 9. Lead pump failure protection.
- G. Motor And Starter: Maximum 40 degrees C ambient temperature rise, dripproof type motor, ball bearings, for operation with current of voltage, phase and cycle shown in Schedule on Electrical Drawings, conforming to NEMA 250 Type-4. Motor shall be of such capacity that brake horsepower required by driven equipment at normal rated capacity will not exceed nameplate rating of the motor. Provide each motor with automatic, fully enclosed, magnetic starter of type specified in Division 26, Electrical.
- H. Instrumentation: All instrumentation shall be factory installed and shall include the following 4½" dial gauges with shut-off cock.
1. Pump pressure gauge for each pump.
 2. System pressure gauge.
 3. Suction pressure gauge.
- I. Operating and Emergency Controls:
1. High system pressure switch with audible alarm system.
 2. Low system pressure switch with audible alarm system.
 3. System flow sensors - duplex.

- 4. Temperature Protection System: Each pump shall be fitted with temperature probe fittings, and solenoid purge valve system. This system shall prevent overheating of the pumps when system is operated manually and when system is operated on emergency.
- J. System using constant speed, close coupled, centrifugal pumps will be acceptable.

PART 3 EXECUTION

3.1 GENERAL

- A. Install in accordance with the manufacturer's published installation instructions, the requirements of these specifications and as indicated on the Drawings.
- B. Startup shall be in accordance with manufacturer's instructions. Provide any equipment lubrication or other recommended procedure as part of startup is so specified by the manufacturer.

3.2 TEST

- A. Make tests under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test.

3.3 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 33 36

ELECTRIC COMMERCIAL WATER HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial electric storage tank water heaters.
- B. Instantaneous electric water heaters.

1.2 REFERENCE STANDARDS

- A. General: References used throughout Division 22 are generally accepted industry standards. The edition of the criteria cited shall be that in force at the time of bid. The Contractor shall provide all work in accordance with codes and standards in force in the Authority Having Jurisdiction for the project, to include all local amendments.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. American Society of Mechanical Engineers (ASME)
 - 1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels
- D. International Association of Plumbing and Mechanical Officials (IAPMO)
 - 1. UPC - Uniform Plumbing Code
- E. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code (NEC)
- F. Underwriters Laboratories (UL)
 - 1. Building Materials Directory
- G. Washington Administrative Code (WAC)

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.
 - 6. Training certificates.

1.4 QUALITY ASSURANCE

- A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors. [Spec writer note – Section VIII is more rigorous and adds considerably to the cost, invoke this for larger high-profile projects.]

- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 and the Washington State Energy Code.

PART 2 PRODUCTS

2.1 GENERAL

- A. All heaters shall be NEC certified.
- B. Heaters shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable settings for the intended use.
- C. A separate switch shall be provided to permit turning off the energy supplied to electric service water heating systems.

2.2 ELECTRIC STORAGE TANK WATER HEATERS

- A. General
 - 1. The heater shall be for vertical installation with lifting lug access and channel skid base.
 - 2. Entire vessel and electrical controls are to be encased in a sheet metal enclosure with baked enamel finish.
 - 3. Enclosure shall have hinged locking door over electric controls.
 - 4. The entire water heating package shall be prewired to solderless terminal lugs, factory tested, complete with a CSA Certified and ASME Rated T&P relief valve and bear the Underwriters' Laboratories label.
- B. Tank
 - 1. Vessel shall be constructed to Section IV of the ASME Code for 125 psi working pressure.
 - 2. Vessel shall be glass-lined with anodic protection.
 - 3. Tank shall be insulated with fiberglass insulation.
- C. Heating Elements
 - 1. Heating elements shall be individually replaceable heavy duty Incoloy sheathed heating elements each complete with prewired terminal leads.
- D. Controls
 - 1. Heating elements shall be switched by magnetic contactors which are operated by a 120V fused control circuit protected by manual reset high limit.
 - 2. Control circuit is activated by a master pilot switch and electronic low water cutoff. This control shall prevent the entire electrical load from being switched on instantaneously.
 - 3. The control shall have even load progressive sequencing which utilizes the "first on, first off" principle thereby equalizing the operating time of heating elements and contactors.
 - 4. Each magnetic contactor and heating element circuit will be protected by a maximum of 60 amp cartridge type fuses with a minimum of 100,000 amp interrupting capacity.
- E. Options:
 - 1. General: Provide the water heater with the following factory options.
 - 2. Provide water heater with factory supplied BACNet gateway for connection to building management systems.
 - 3. Pilot lights and switches to denote heating stages in operation.
 - 4. Safety door interlock.
 - 5. Factory installed dial-type pressure gauge.
 - 6. Factory installed dial-type temperature gauge.
- F. Warranty
 - 1. Heater(s) shall have a 3-year limited warranty.

2.3 INSTANTANEOUS TYPE ELECTRIC WATER HEATERS

- A. Microprocessor-based instantaneous electric water heater. Microprocessor shall sample the water temperature a minimum of 120 times per second. Maximum output temperature shall be preset at factory. Housing shall be satin-finished stainless steel. Heating element shall be fabricated from Celcon plastic. Heating coils shall be nichrome. Heater shall be supplied from factory with faucet flow control and compression fittings.
- B. Heater shall be operable down to 0.5 GPM water flow and with a minimum water pressure of 25 PSI.
- C. Heater shall be UL listed, and meet UPC standards with respect to construction, installation and accessibility.

PART 3 EXECUTION

3.1 GENERAL

- A. Install heaters per manufacturers published installation instruction and the requirements of Chapter 5 of the Uniform Plumbing Code. This includes seismic anchoring.
- B. Provide rebar-reinforced concrete housekeeping pad for floor-mounted water heaters.

3.2 LEED REQUIREMENTS:

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Mop sinks.
- F. Electric water coolers.
- G. Drinking fountains.
- H. Showers.
- I. Appliance connection boxes.

1.2 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- C. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- C. Refer to Division 1 for submittal procedures and Section 22 05 00 - Common Work Results for Plumbing.
- D. Required submittals:
 - 1. Product data.
 - 2. Training certificates.
- E. LEED Submittals
 - 1. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Materials and Resources Submittals:
 - 1) MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.6 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.

- D. Install and secure fixtures in place with wall carriers and bolts.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.7 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.8 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General requirements for Division 23 (HVAC).

1.2 SUMMARY

- A. Section includes all general requirements that apply to the entirety of Division 23 - HVAC, both interior and exterior to the building, as indicated on the plans and specified herein.
- B. All specification sections with Division 23 - HVAC are complementary. All specification sections within Division 23 shall be considered to reference each other.
- C. Provide all HVAC work as indicated in the drawings and specified herein.

1.3 REFERENCE STANDARDS

- A. American Institute Of Steel Construction (AISC)
- B. International Code Council (ICC)
 - 1. IMC - International Mechanical Code
 - 2. IBC - International Building Code
 - 3. IFC - International Fire Code
- C. National Fire Protection Association (NFPA)
 - 1. NFPA 70 - International Electrical Code
- D. Sheet Metal And Air Conditioning Contractors' National Association (SMACNA)
 - 1. SMACNA 1650 - Seismic Restraint Manual Guidelines for Mechanical Systems, 2nd Edition
 - 2. SMACNA 1966 - HVAC Duct Construction Standards Metal and Flexible, 3rd Edition
- E. Underwriters Laboratories (UL)
 - 1. Building Materials Directory

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide product data for all components and equipment provided under this Division.
 - 1. Product sheets with more than one item or option shown shall have the product(s) and options to be used on the project clearly identified.
 - 2. Any equipment or materials installed or furnished without prior approval of the Owner's Representative shall be rejected and such materials will be required to be removed and replaced with approved materials at the expense of the Contractor.
- C. Shop Drawings:
 - 1. Shop drawings shall be submitted for review and approval prior to beginning work.
 - 2. Shop drawings shall indicate routing of piping and location of all equipment to be provided, and shall reflect coordination with other disciplines and existing conditions.
- D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.

- E. Field Quality Control Submittals: Indicate test reports, inspection reports, and commissioning reports.
- F. Project Record Documents:
 - 1. Record actual routing of installed piping and ductwork, including elevation (or depth for buried items).
 - 2. Record actual equipment and components installed, as well as locations.
 - 3. RFI's, change orders, and the like shall be noted on the Record Documents where these affect the layout or other aspect of project shown on the documents. References to these shall include the RFI/change order number as well as written description(s), sketch(es), etc., indicating the change or clarification.
 - 4. Record actual location of installed valves, sensors, dampers, and other control components.
 - a. Include riser diagram(s) and schedule of valve tags and locations.
 - 5. Record actual location and type of vibration isolation devices.
 - 6. Final record documents:
 - a. Upon completion of the project the as-built information shall be neatly transferred to a clean set Plans. This set of Plans shall be submitted for final approval and acceptance.
- G. Operation and Maintenance (O&M) Data:
 - 1. Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.
 - 2. Include manufacturer's warranty information, including any extended warranties, or certifications of warranties required for specific products, systems, or installations.
 - 3. Include certification of inspection(s) from the Authority Having Jurisdiction for the applicable work scope(s).
 - 4. Include certification of training.
 - 5. Include certification of Contractor's one-year warranty of materials and workmanship, including effective date(s) of warranty period.
- H. Seismic support calculations and any related required certification(s).
- I. Warranty Information:
 - 1. Certificate of installing contractor's one-year warranty.
 - a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).
 - 2. Certificate of product manufacturer's warranty.
 - a. Warranty certificate shall specifically list project information, owner information, start and end dates of warranty period, and specific description of coverage (materials, labor, other costs, etc.).

1.5 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in manufacturing products specified in Division 23 with a minimum of three years documented experience.
- B. Contractor: Mechanical work required under this Division shall be performed by a Washington State Licensed Mechanical Contractor.
- C. Electrical work required under this Division shall require an Electrical Permit.
 - 1. Electrical permit shall be procured by the Division 23 contractor or their electrical subcontractor.
- D. Electrical Equipment
 - 1. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical connection(s), such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., shall be provided with an approved label from either

Underwriters Laboratories (UL), the American Gas Association (AGA) or the Canadian Standards Association (CSA).

2. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector.
- E. Performance Certification: All equipment performance (airflow, heating capacity, cooling capacity, etc.) shall be certified by a recognized national agency such as the Air Conditioning and Refrigeration Institute (ARI), Air Movement and Control Association (AMCA) and the American Society of Mechanical Engineers (ASME).

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure and finish.
- C. Protect products from weather and moisture. Provide coverings of plastic or canvas. Cover openings into pipe and duct. Isolate components from contact with the soil. Provide a means of heating for those components that may become damaged by high or low temperatures.
- D. For extended outdoor storage, remove motors and other electrical equipment from enclosures not designed for outdoor use and store separately.

1.7 DEFINITIONS

- A. The term "approved equal" means final approval by the Architect of a material or piece of equipment substituted for that which is shown in the Specifications or Plans.
- B. The term "provide" means the furnishing and installing of equipment (including connections and appurtenances) complete and ready for use.
- C. The term "Mechanical Contractor (MC)" and "Electrical Contractor (EC)" as used in these Specifications or on the Contract Drawings, refer to those subcontractors working under the direction of the General Contractor (GC).

1.8 MISCELLANEOUS REQUIREMENTS

- A. Intent of Drawings
 1. The drawings are intended to depict the general scope of arrangement. The drawings are diagrammatic and do not show the exact details and locations, nor all offsets in ductwork and piping. Provide additional fittings, offsets and extensions in piping, ductwork and related items to provide full systems functionality and to assure access for equipment maintenance and as detailed elsewhere in the contract. Relocate or shift piping and ductwork where conflict exists with other plumbing or mechanical systems, structural elements, architectural elements, or electrical systems, or other project work scope(s). Report conflicts before proceeding with work. Provide reasonable planning and layout in advance of installation in order to avoid conflicts and delays. The Contractor will be directed to adjust systems due to conflicts that could have been reasonably foreseen at the Contractor's own expense.
 2. Examine the Architectural, Structural, Electrical, and other project drawings before work is started. Consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to provide reasonable coordination shall result in the Contractor, at his own expense, moving his work to provide the necessary space for the other Contractors.
- B. Permits and Fees: Obtain and pay for all permits and construction fees. Furnish Final Certificate to Owner showing compliance with code requirements.

- C. Scheduling: Comply with requirements of Division 1.
- D. As-Specified Equipment: These specifications and drawings generally list only one make and model number for each item of equipment or material required for the project. This is not intended to be restrictive but is intended to indicate the standard of quality, design and features required. In addition the listed product is the basis of the design regarding physical size, capacity, electrical power requirements and performance. The product so identified is designated "as specified."
- E. Prior Approvals:
 - 1. Specifications have been written around equipment and materials selected for this project based on quality, size, capacity, and performance required to meet building design criteria. All equipment and materials used in this project that have been specified around a specific product or products shall have prior approval for product substitutions.
 - 2. Request for Approval must be submitted in accordance to Division 1 requirements,
 - 3. Supplier and/or Mechanical Contractor shall be responsible to ensure that substituted material or equipment is of same size, quality, capacity, weight and electrical characteristics as that specified or shown on the drawings. Any changes and cost increases required during construction due to substituted equipment shall be paid by the Contractor/Supplier. Prior approval to bid does not mean final approval of material or equipment. Final approval will be given after final submitted data has been presented, complete with full information regarding weights, capacities, size, electrical requirements and quality.
- F. Contractor's Cost Breakdown: Submit a cost breakdown (schedule of values) of the major portions of the work. Provide this submittal along with the equipment submittals. Organize the costs generally by specification section. For example, if one Section (such as copper piping) applies to both plumbing and hydronics, apportion the appropriate amount to each area of work.

1.9 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for general demonstration and training requirements.

1.10 REQUESTS FOR INFORMATION

- A. Refer to Division 1 for Request for Information (RFI) requirements.

PART 2 PRODUCTS

2.1 DAMAGED OR REJECTED MATERIALS

- A. Damaged or rejected materials shall be removed from the site immediately upon discovery.

2.2 FIRE INTEGRITY

- A. All mechanical system penetrations of fire rated assemblies shall be protected in accordance with the building code in force in the Authority Having Jurisdiction for this project. This includes piping, ductwork, supports, conduit, and any other system and appurtenance provided by Division 23. In addition, all through-penetration sealing methodologies shall be listed in the Underwriter's Laboratories (UL) Fire Resistance Directory, issue current at time of bid.

PART 3 EXECUTION

3.1 CODE COMPLIANCE

- A. The Contractor shall comply with all applicable codes and requirements including but not limited to:
 - 1. International Building Code, including local amendments.
 - 2. International Fuel Gas Code, including local amendments.
 - 3. International Mechanical Code, including local amendments.
 - 4. International Fire Code, including local amendments.
 - 5. Uniform Plumbing Code, including local amendments.
 - 6. National Electrical Code (NFPA 70), including local amendments.
 - 7. Washington State Energy Code
 - 8. Requirements of the local Authority Having Jurisdiction (AHJ).
 - a. Authority Having Jurisdiction: City of Redmond.

3.2 LAYING OUT WORK

- A. Locate all general reference points and take such action as is necessary to prevent their destruction lay out work and be responsible for all lines, elevations, grading for utilities and other work required under the Contract. Exercise proper precaution to verify figures shown on drawings before laying out work and be responsible for any error resulting from failure to exercise such precaution. Coordinate the utility installation with the final site grading and elevations. Locate existing utility lines that will be affected by the building location before any footing work begins. Report conflicts with the Plans before proceeding with the work. Failure to follow reasonable precautions with regards to this instruction will require Contractor to alter the work at the Contractor's expense.

3.3 ELECTRICAL WORK

- A. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to the NEC and other all applicable codes.
- B. All electrical work performed under this Section of the Specifications shall require a permit. Contractor shall obtain and pay for all required permits and fees.
- C. All electrical work performed under this Section of the Specifications shall be performed by a electrician licensed in the jurisdiction where the work is performed.

3.4 WORKMANSHIP

- A. Furnish and install all equipment in a neat and finished appearance. If any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, the Contractor shall remove the equipment, reinstall and patch and paint surrounding surfaces without any increase in cost.

3.5 DUCT INSTALLATION

- A. Ductwork shall not be located over electrical panels or switchboards except where located above the structural ceiling.

- B. Lay below-grade duct and piping in straight lines with uniform slope. Care shall be taken to keep all foreign materials out of the duct and pipes during installation.

3.6 OPENINGS IN PIPES AND DUCTS

- A. Keep closed during the work.

3.7 INSERTS

- A. Inserts in concrete for the suspension of piping and equipment shall be provided by this Contractor unless otherwise noted on the Plans. Inserts in "poured in place" concrete shall be Grinnell, Kinsdorf, Elcen, or approved equal. Provide as necessary for support of systems installed.

3.8 CUTTING AND PATCHING

- A. General:
 - 1. Provide all saw cutting, core drilling, and other work (including patching) necessary for installation of mechanical systems.
 - 2. Prior to cutting, saw cutting, or core drilling any concrete, Contractor shall locate any reinforcing steel (rebar) and the like located in the concrete where the cutting is to be performed. Obtain specific approval from the Architect prior to cutting any concrete reinforcement. Approval must be obtained for each specific instance of cutting reinforcement.
 - 3. Unless directed otherwise by Structural Documents, maintain the following minimum clearances from any concrete reinforcement:
 - a. Reinforcing steel: 2"
- B. New Work: Provide openings in walls, floors, foundations, etc. for pipe, duct and associated items required for installation under Division 23 are provided. Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample coordination time to avoid delays and unnecessary labor. The expense for cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be borne by this Contractor.
- C. Existing Structure:
 - 1. All necessary cutting and patching of existing structures necessary for the installation of mechanical work shall be as part of this Contract. Unless cutting and patching locations are specifically shown on the drawings, obtain approval prior to proceeding.
 - 2. All surfaces must be patched upon completion of work. Final finish of all patched surfaces (walls, ceilings, floors etc.) shall be done per finish schedules shown on the Architectural Drawings or patched to match the adjacent surface.
 - 3. Contractor shall locate all steel in existing structure using x-ray or similar scanning equipment prior to cutting into existing structure.

3.9 MAINTENANCE AND OPERATION ACCESS

- A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
 - 1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
 - 2. Access door locations; shall be approved by the Architect prior to installation.

- B. Access Panels
 - 1. Provide access panels for all concealed equipment, dampers, and the like that requires adjustment or service access. Panel locations shall be carefully selected on the job so as not to be located behind cabinets, lights, etc.
 - a. Coordinate with the work of other Contractors before installing panels.
 - b. Panels shall be prime coated and painted to match surrounding surface.
 - c. In finished areas, including ceilings, all access panels shall have the same type of finished surface as that of the surrounding area.
 - d. Panels shall be size appropriate for the service intended.
 - e. Provide UL labeled fire rated access doors for one or two-hour rated walls and ceilings.
 - f. Install before surrounding surfaces have been painted.
 - g. Access panel doors shall have cylinder lock latch, all keyed alike.
 - h. Provide access doors in ceiling or wall adjacent to all fire damper locations.
 - i. Verify with Architect the location and finish of all access panels.
 - j. Panels shall be J.R. Smith, or equal.
- C. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair.
 - 1. In concealed spaces where access has not been provided by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the service intended, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflicts.
 - 2. Access door locations; shall be approved by the Architect prior to installation.
- D. In addition to building access openings, provide access panels on ducts where required to service fire dampers, damper operators, and other equipment requiring adjustment or maintenance.
 - 1. Duct access openings shall be constructed in accordance with SMACNA Duct Construction Standards, Metal and Flexible.
 - 2. All access doors to mechanically furnished panels, control boxes and filter compartments shall be provided with fully hinged, easily opened access doors.

3.10 TEMPORARY HEATING

- A. The Contractor shall be responsible for providing temporary heating for all spaces affected by work under this contract.
- B. The Contractor shall coordinate any temporary utility (such as gas, electric, etc.) required to provide temporary heating.
 - 1. The building electrical system may be used.
 - a. The Contractor shall be responsible for providing temporary electrical connection(s) to the electrical system.
 - b. The Owner will pay for electrical energy used as part of their normal utility payment.
- C. Maintain the following space conditions:
 - 1. General spaces: 60°F
 - a. During concrete work and curing: Refer to concrete specifications for condition requirements.
 - b. During painting work and curing: Refer to painting specifications for condition requirements.
 - 2. Natatoriums: 60°F
 - a. During pool plaster work and curing: Refer to pool plaster specifications for condition requirements.
 - 3. IT and server rooms: 60-90°F and 20-50% RH

- D. Air handling units, unit heaters, and other equipment installed as permanent units under this contract may not be used as temporary conditioning units during construction.
- E. Where specifically allowed in writing by the Owner, equipment installed as permanent units under this contract or existing equipment may be used for temporary space conditioning during construction, subject to the following conditions:
 - 1. The building must be clean of all dust before starting units.
 - 2. Temporary filter media (80 % to 85 % efficient) for all return air, fresh air, exhaust and relief air systems shall be provided.
 - 3. All windows, doors or other openings in the building must be closed off.
 - 4. Upon completion of the job, provide new filters for all units, size and type as specified for normal operation of the equipment in Division 23.

3.11 VIBRATION ISOLATORS

- A. General: Provide vibration isolation per the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Applications Manual, Chapter "Sound and Vibration Control". Vibration isolation shall be provided for both isolation from the building structure (devices such as spring hangers, rubber in shear isolators, etc.) and isolation from the mechanical system (devices such as pipe and duct flexible connections). This ASHRAE reference details specifically the method, type of device, and device selection required. Refer to Table 47, "Selection Guide for Vibration Isolation".
- B. Vibration isolation may be combined with the seismic support system, if certified by the isolation equipment manufacturer.

3.12 SEISMIC SUPPORT

- A. Ductwork: Support ductwork per the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Seismic Restraint Manual Guidelines for Mechanical Systems. Use Seismic Hazard Level-A unless otherwise indicated.

3.13 EQUIPMENT LUBRICATION

- A. All air handling equipment including fans, air handling units, DOAS units, heat pumps, and heat recovery units, etc., shall have all lubrication fittings on the equipment exterior.

3.14 FIRE INTEGRITY

- A. Maintain the fire rating of all assemblies (wall, ceiling, floor, etc) penetrated by mechanical systems. Provide approved firestopping materials as previously specified, and install in accordance with the conditions of the material UL listing.

3.15 PRESSURE TESTS AND IN-SERVICE TESTS

- A. All work under this Contract shall be thoroughly and systematically tested, both during construction and after completion. Testing of systems and/or components shall be either as specified in the appropriate specification section, or as specified in the applicable code. Tests shall be maintained until approved.
- B. Notifications shall be sent to the following parties 48 hours in advance of all tests:
 - 1. Architect.
 - 2. Owner.
 - 3. Authority Having Jurisdiction over the specific work to be inspected.

- a. Notifications to AHJ shall be provided in accordance with requirements of each specific AHJ, including amount of advance notice allowed.
- C. No systems, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing without first notifying all of the above-listed parties for inspection. Failure to provide such notification of concealed systems shall be cause to require this Contractor to uncover and re-cover such systems at no additional cost.
- D. A log of all tests shall be kept. The log shall note date, time of day test started, system or portion of system tested, length of test and test results.
- E. The Contractor shall test the completed installation as in regular service. The systems provided under this Contract shall be operated in normal service for a period of at least a week prior to requesting substantial completion inspection, and any resulting defects repaired.
- F. The Contractor shall guarantee the entire system and all parts thereof for a period of one year from the date of final acceptance, and shall repair or replace any part which may show signs of failure in that time if such failure is due to imperfections in material or to improper workmanship.

3.16 STARTUP, BALANCING AND COMMISSIONING

- A. Equipment Startup
 - 1. Equipment utilized on this project was installed and started up under an earlier project phase.
- B. Testing and Balancing
 - 1. Refer to Section 23 05 93 for testing and balancing requirements.
 - 2. Provide any necessary impeller trimming or other modifications to mechanical equipment required for specified performance.
- C. Commissioning
 - 1. Provide system adjustment to demonstrate compliance with design documents. Provide documentation to meet basic commissioning requirements of Washington State Energy Code section C408.

3.17 CLEANING UP

- A. Comply with requirements of General Specifications (Division 1, General Conditions, Etc.).
- B. Ducts shall be maintained as clean as possible during erection, and shall be blown clean before the building field painting operations are started. Ducts and apparatus casings shall be thoroughly cleaned before fans and filters are operated. After equipment has been used for any purposes, such as adjusting, testing, or temporary ventilation, filters shall be cleaned or renewed and exhaust/return ducts shall be cleaned. Use temporary filters with 80% to 85% filter efficiency during construction.
- C. All equipment and material installed shall be properly protected from damage during the course of construction.
- D. In utility rooms and other spaces where piping such as condensate drains, heating water, chilled water, or refrigeration lines have been installed at floor level and interfere with foot traffic, the Mechanical Contractor shall provide covers to protect these pipes. Wood or other such material is acceptable. Where duct plenums or duct runs interfere with normal traffic pattern of maintenance personnel, the Mechanical Contractor shall provide a wooden bridge over the ducts to prevent damage. Provide handrails for bridge(s) where required by code.

3.18 SPECIAL PROTECTION

- A. Exercise maximum precaution to provide positive protection for the building and equipment from damage of any kind, and in particular, prevent water and dust seepage into new equipment.
- B. Repair all damage to the building, systems, or property, caused by the Contractor at no additional cost to the Owner. This provision shall include any preventable damage caused by lack of due diligence in planning and investigation, and shall not be applied to field conditions which could not reasonably be ascertained prior to the activity causing damage.
- C. In attic or other spaces where ductwork has been installed at floor level and interferes with foot traffic, the Contractor shall provide permanent covers to protect these items. Wood or other such material is acceptable. Provide handrails where required by code.

3.19 CAULKING

- A. Caulk all openings and flash around all ductwork passing through roof, floor, and walls.
- B. All caulking shall be water resistant, zero-VOC, zero mold growth, LEED qualified, and water based type.
- C. Refer to paragraph "Fire Integrity" for all rated wall, ceiling, roof, floor, and other penetrations.

3.20 FINAL INSPECTION

- A. This Contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall provide notification. It shall be understood that the work shall be essentially complete, and the open items list provided at that time. The warranty period will not start until the punchlist and back-check are complete. Additional inspections required because of lack of diligence by the Contractor will be conducted on a schedule convenient to the inspectors.

3.21 INSTRUCTION PERIODS

- A. Refer to Division 1 for additional demonstration and training requirements.
- B. Scope: Following installation of mechanical work, have representatives of installation tradesmen conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance to Owner's staff.
- C. General Description Of Instruction Period: Each period shall include preliminary discussion and presentation of information from maintenance manuals with appropriate references to drawings followed by tours of building areas explaining maintenance requirements, access methods, servicing and maintenance procedures, and equipment cleaning procedures, temperature control settings and available adjustments.
- D. Scheduling Of Instruction Period: Notice of Contractor's readiness to conduct such instruction and demonstration shall be given at least two weeks prior to the instruction period, and agreement finalized as to the date at which the instruction period is to be performed. Notify two weeks prior to date when ready to conduct instruction and demonstrations receive approvals of proposed date prior to making final arrangements.
- E. Comply with training and training reporting requirements enumerated in Chapter 14 of the Washington State Energy Code, WAC 51-11.

3.22 ON SITE OBSERVATIONS AND SAFETY MEASURES

- A. The Contractor is solely responsible to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The duty of any other individual or organization to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site. The contractor shall be responsible for providing all safety measures and shall consult with the State and/or Federal Safety Agency or Inspector for interpretation whenever in doubt as to compliance with State and/or Federal regulations. Furthermore, the Contractor distinctly assumes all risk or damages or injury to any persons or property wherever located resulting from any action or operation under this Contract or in connection with the work.

3.23 CONTINUITY OF BUILDING AND UTILITY AND SHUTDOWNS

- A. General: Continuity of utilities services in the building shall be maintained at all times as required to provide heat, water, lighting, and power to all portions of the building. Utility systems shutdowns required for extensions, alterations or connections of new services shall be accomplished in accordance with the following requirements.
- B. Shutdowns:
 - 1. While building is in operation, utilities shutdowns shall be scheduled for weekends, holidays, or at night, if the shutdown affects the use of the building or surrounding buildings.
 - 2. Shutdowns longer than 2 hours shall be coordinated with and approved by the Owner at least 1 week in advance.
 - 3. Shutdowns less than 2 hours shall be coordinated with and approved by the Owner at least 48 hours in advance.
- C. Costs: The Contractor shall include in their bid proposal all costs associated with utilities shutdowns. No extra payment will be made for overtime work, schedule changes or failure to complete utilities connections within authorized shutdown periods.
- D. Coordinate with the serving utility and pursue the work in timely manor to return utilities to service.
- E. Liability: Failure to coordinate with the serving utility or to sufficiently pursue the work in time to return utilities to service shall not constitute a basis for avoiding any contractual penalties.

3.24 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.25 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 05 23

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Applications.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.

1.2 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2017.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- F. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017.
- G. ASME B31.9 - Building Services Piping; 2014.
- H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
- I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- K. MSS SP-67 - Butterfly Valves; 2011.
- L. MSS SP-68 - High Pressure Butterfly Valves with Offset Design; 2017.
- M. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.4 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 2. Protect valve parts exposed to piped medium against rust and corrosion.
 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 5. Secure check valves in either the closed position or open position.
 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
 1. Throttling (Hydronic): Butterfly and Ball.
 2. Isolation (Shutoff): Butterfly and Ball.
 3. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze with bronze disc.
 - b. 2-1/2 NPS and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.
- B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- C. Heating Hot Water Valves:
 1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Ball: Full port, three piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 2. 2-1/2 NPS and Larger, Brass and Bronze valves:
 - a. Threaded ends.
 - b. Ball: Full port, three piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 3. 2-1/2 NPS and Larger, Iron Valves:
 - a. Butterfly: High performance, single flange, Class 150.

2.2 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.

- C. Valve Actuator Types:
 - 1. Hand Lever: Quarter-turn valves 6 NPS and smaller.
- D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
 - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: Extended neck.
 - 3. Memory Stops: Fully adjustable after insulation is installed.
- E. Memory Stops: Fully adjustable after insulation is installed.
- F. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 - 3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
 - 4. Solder Joint Connections: ASME B16.18.
- G. General ASME Compliance:
 - 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Building Services Piping Valves: ASME B31.9.
- H. Bronze Valves:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- I. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRASS, BALL VALVES

- A. Three Piece, Full Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 150 psig.
 - 3. CWP Rating: 600 psig.
 - 4. Body: Forged brass.
 - 5. Ends: Threaded.
 - 6. Seats: PTFE or TFE.
 - 7. Ball: Stainless steel, vented.

2.4 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Three Piece, Full Port with Stainless Steel Trim:
 - 1. Comply with MSS SP-110.
 - 2. SWP Rating: 150 psig.
 - 3. CWP Rating: 600 psig.
 - 4. Body: Bronze.
 - 5. Ends: Threaded.
 - 6. Seats: PTFE.
 - 7. Ball: Stainless steel, vented.

2.5 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style: Bi-directional dead-end service without use of downstream flange.

1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig, and 200 psig.
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.

2.6 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug type: Bi-directional dead end service without downstream flange.
 1. Comply with MSS SP-68.
 2. Class 150: CWP Rating: 285 psig, and Class 300: CWP Rating: 720 psig at 100 degrees F.
 3. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
 4. Seat: Metal or reinforced PTFE.
 5. Offset stem: Stainless steel.
 6. Disc: Carbon steel.

2.7 BRONZE, SWING CHECK VALVES

- A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).
 1. Comply with MSS SP-80, Type 3.
 2. Body Design: Horizontal flow.
 3. Body Material: Bronze, ASTM B62.
 4. Ends: Threaded.
 5. Disc: Bronze.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 1. Swing Check: Install horizontal maintaining hinge pin level.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment components for HVAC equipment and piping.

1.2 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- G. MFMA-4 - Metal Framing Standards Publication; 2004.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

1.5 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
- C. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
- D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
 - c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
- E. Pipe Supports:
 - 1. Manufacturers:
 - a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
 - 2. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
- F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
 - 1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 - 2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- G. Riser Clamps:
- H. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- I. Strut Clamps: Two-piece pipe clamp.
- J. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
- K. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
 - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 - 2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

- L. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- M. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 3. Hollow Stud Walls: Use toggle bolts.
 - 4. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 - 5. Sheet Metal: Use sheet metal screws.
 - 6. Wood: Use wood screws.
 - 7. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

3.4 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
 - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Seismic restraint systems.

1.2 DEFINITIONS

- A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVAC) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- E. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Seismic Controls:

- a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
 - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.5 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
 1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
 2. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 3. Indicate proposed arrangement of distributed system trapeze support groupings.
 4. Indicate proposed locations for distributed system flexible fittings and/or connections.
 5. Indicate locations of seismic separations where applicable.
- F. Evidence of qualifications for seismic controls designer.
- G. Field quality control test reports.

1.6 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
 1. Designer may be employed by the manufacturer of the seismic restraint products.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
 - 4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Piping Isolation:
 - 1. Provide vibration isolators for piping supports:
 - a. Located in equipment rooms.
 - b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
 - c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
 - 2. Minimum Static Deflection:
 - a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
 - 3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
 - 4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
 - 5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
 - 6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
 - 7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.2 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Manufacturers:

2.3 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
 - 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 - 2. Spring Elements for Spring Isolators:

- a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
- a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Nonseismic Applications:
- 1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
 - 2. Resilient Material Isolator Mounts, Nonseismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
 - 3. Open (Unhoused) Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
 - b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - 4. Housed Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
 - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
 - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - d. Furnished with integral leveling device for positioning and securing supported equipment.
 - 5. Restrained Spring Isolators, Nonseismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
 - b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
 - 6. Resilient Material Isolator Hangers, Nonseismic:

- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
- 7. Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- 8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- D. Vibration Isolators for Seismic Applications:
 - 1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - 2. Restrained Spring Isolators, Seismic:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
 - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
 - c. Furnished with integral leveling device for positioning and securing supported equipment.
 - d. Provides constant free and operating height.
 - 3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - 4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
 - 5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.4 ACOUSTICAL AND VIBRATION ISOLATORS

- A. General Requirements:
 - 1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

2.5 SEISMIC RESTRAINT SYSTEMS

- A. Manufacturers:
 - 1. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
 - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.

- D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- F. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 - 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 - 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 6. Adjust isolators to be free of isolation short circuits during normal operation.
 - 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- G. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 - 5. Seismic Restraint Systems:

- a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
- b. Install restraints within permissible angles in accordance with seismic design.
- c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
- d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Vibration Isolation Systems:
 1. Verify isolator static deflections.
 2. Verify required clearance beneath vibration-isolated equipment support bases.
 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.5 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Pipe markers.
- E. Ceiling tacks.

1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

- A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - a. Final locations of all sections of heat trace, including service and approximate length.
 - b. Final locations of all controls.
 - c. Record of power connections (panel and circuit number) for each section of heat trace.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.
 - 6. Training certificates.
- C. LEED Submittals
 - 1. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Low-Emitting Materials Submittals:
 - 1) EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Automatic Controls: Tags. Key to control schematic.
- C. Control Panels: Nameplates.
- D. Ductwork: Duct markers.
- E. Heat Transfer Equipment: Nameplates.
- F. Piping: Pipe markers.
- G. Pumps: Nameplates.
- H. Tanks: Nameplates.
- I. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

- A. Letter Color: White.
- B. Letter Height: 1/4 inch.
- C. Background Color: Black.
- D. Plastic: Comply with ASTM D709.

2.3 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 ADHESIVE-BACKED DUCT MARKERS

- A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.
- B. Style: Individual Label.
- C. Color: Yellow/Black.

2.5 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- C. Color code as follows:
 - 1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.6 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Install ductwork with duct markers. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- E. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of domestic water systems.
- C. Testing, adjustment, and balancing of fire suppression systems.
- D. Testing, adjustment, and balancing of hydronic systems.
- E. Measurement of final operating condition of HVAC systems.
- F. Commissioning activities.

1.2 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Submit to the Commissioning Authority.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include at least the following in the plan:
 - a. List of all air flow and water flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Details of how TOTAL flow will be determined; for example:
 - 1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
 - 2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
 - f. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
 - g. Time schedule for TAB work to be done in phases (by floor, etc.).

- h. Time schedule for deferred or seasonal TAB work, if specified.
 - i. False loading of systems to complete TAB work, if specified.
 - j. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
 - k. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Field Logs: Submit at least once a week to the Commissioning Authority.
- E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- F. Progress Reports.
- G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 - 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Engineer.
 - h. Project Contractor.
 - i. Report date.
- H. Project Record Documents: Record actual locations of balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- E. Pre-Qualified TAB Agencies:
 1. Neudorfer Engineers, Inc..

3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed complete and operable.
 3. Proper thermal overload protection is in place for electrical equipment.
 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 5. Duct systems are clean of debris.
 6. Fans are rotating correctly.
 7. Fire and volume dampers are in place and open.
 8. Air coil fins are cleaned and combed.
 9. Access doors are closed and duct end caps are in place.
 10. Air outlets are installed and connected.
 11. Duct system leakage is minimized.
 12. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Proper strainer baskets are clean and in place.
 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
 1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

3.4 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.
- D. Domestic plumbing systems: Adjust to within plus or minus 10 percent of design for hot water recirculation systems.

3.5 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
 - 1. Running log of events and issues.
 - 2. Discrepancies, deficient or uncompleted work by others.
 - 3. Contract interpretation requests.
 - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.7 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

- D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 COMMISSIONING

- A. See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
 - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 50 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.
 - 3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 - 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
 - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
 - c. Temperatures: Deviation of more than one degree F.
 - d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
 - e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
 - 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
 - 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 - 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 - 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all

balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.9 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Fire Pumps.
 - 2. Plumbing Pumps.
 - 3. HVAC Pumps.
 - 4. Air Coils.
 - 5. Air Handling Units.
 - 6. Fans.
 - 7. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.
- B. Pumps:
 - 1. Identification/number.
 - 2. Manufacturer.
 - 3. Size/model.
 - 4. Impeller.
 - 5. Service.
 - 6. Design flow rate, pressure drop, BHP.
 - 7. Actual flow rate, pressure drop, BHP.
 - 8. Discharge pressure.
 - 9. Suction pressure.
 - 10. Total operating head pressure.
 - 11. Shut off, discharge and suction pressures.
- C. Electric Duct Heaters:
 - 1. Manufacturer.
 - 2. Identification/number.
 - 3. Location.
 - 4. Model number.
 - 5. Design kW.
 - 6. Number of stages.
 - 7. Phase, voltage, amperage.
 - 8. Test voltage (each phase).
 - 9. Test amperage (each phase).
 - 10. Air flow, specified and actual.
 - 11. Temperature rise, specified and actual.
- D. Air Moving Equipment:
 - 1. Location.
 - 2. Manufacturer.
 - 3. Model number.

4. Serial number.
 5. Arrangement/Class/Discharge.
 6. Air flow, specified and actual.
 7. Return air flow, specified and actual.
 8. Outside air flow, specified and actual.
 9. Total static pressure (total external), specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Fan RPM.
- E. Return Air/Outside Air:
1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
 4. Design return air flow.
 5. Actual return air flow.
 6. Design outside air flow.
 7. Actual outside air flow.
- F. Exhaust Fans:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.
 10. Number of Belts/Make/Size.
 11. Fan RPM.
- G. Duct Traverses:
1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
 10. Air correction factor.
- H. Duct Leak Tests:
1. Description of ductwork under test.
 2. Duct design operating pressure.
 3. Duct design test static pressure.
 4. Duct capacity, air flow.
 5. Maximum allowable leakage duct capacity times leak factor.
 6. Test apparatus:
 - a. Blower.
 - b. Orifice, tube size.
 - c. Orifice size.
 - d. Calibrated.
 7. Test static pressure.

8. Test orifice differential pressure.
9. Leakage.
- I. Air Distribution Tests:
 1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.
- J. LEED Requirements
 1. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - a. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - b. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION & LINING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. HVAC equipment insulation, jackets and accessories for all equipment not provided with factory insulation under Division 23.
- B. Duct insulation.
- C. Closed cell duct lining.
- D. Fire-rated wrap for grease exhaust ducts.

1.2 WORK INCLUDED

- A. Provide insulation on all new systems specified under Division 23 as follows:
 - 1. Concealed supply air duct.
 - 2. Outside air duct.
 - 3. Makeup air duct located outside of mechanical rooms.
 - 4. Rigid insulation for all ductwork located in mechanical rooms.
 - 5. Grease exhaust ductwork.
- B. Provide duct lining on all new systems specified under Division 23 as follows:
 - 1. At all areas indicated on the drawings, and at the locations indicated below.
 - 2. 10' upstream of all fans >500 cfm.
 - 3. 10' downstream of all fans >500 cfm.
 - 4. 5' upstream of all fans 250-499 cfm.
 - 5. 5' downstream of all fans 250-499 cfm.
 - 6. Duct systems serving toilet rooms.
 - a. Provide soundlining for all ductwork in the duct system within 10' of toilet rooms.
 - 7. Relief and transfer ducts connecting 2 or more rooms.
 - 8. Duct systems serving areas identified in this specification, specification 220500 "Common Work Results for Plumbing", specification 220548 "Vibration and Seismic Controls for Mechanical Systems", specification 230500 "Common Work Results for HVAC", or specification 230548 "Vibration and Seismic Controls for Mechanical Systems" as being acoustically sensitive.
 - a. Provide soundlining for all ductwork in the duct system within 10' of the acoustically sensitive areas.
- C. Provide duct lining at all locations where duct lining was removed for work under this contract.

1.3 REFERENCE STANDARDS

- A. American Society of Testing and Materials (ASTM)
 - 1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - 2. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board
 - 3. ASTM C411 - Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - 4. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

5. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
6. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
7. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
8. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
9. ASTM C1534 - Standard Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Absorbing Liner for Duct Systems
10. ASTM E84 - Standard Test Methods for Surface Burning Characteristics of Building Materials
11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
12. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests
13. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
14. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
15. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria
- B. Federal Specification (FS)
 1. FS HH-I-558 - Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fittings Covering, Thermal (Mineral Fiber, Industrial Type)
- C. National Fire Protection Association (NFPA)
 1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems
- D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 1. SMACNA 1884 - Fibrous Glass Duct Construction Standards

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 1. Product data.
 2. O&M data.
 3. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals
 1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Materials and Resources Submittals:
 - 1) MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 - LEED Certification Procedures.
 - (a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

- c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.8 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 DUCT INSULATION

- A. General: All insulation products used inside the building or inside ductwork shall have a smoke developed rating of less than 50 and a flame spread rating of less than 25 in accordance with ASTM E84.
- B. Duct Insulation:
 - 1. General: All insulation thickness and conductivity for ductwork shall be per the Latest Edition of the Washington State Non-Residential Energy Code.
 - 2. Concealed duct insulation shall be flexible blanket fiber glass duct insulation, 0.60lb per cubic foot density, with Foil-Scrim-Kraft facing and shall comply with HH-I 558, Type-1, Class-6.
 - 3. Rigid duct insulation shall be fibrous glass ductboard. Duct material shall be per the SMACNA Fibrous Duct Construction Standards and shall comply with NFPA 90A. Provide a Foil-Skrim-Kraft (FSK) jacket.
 - 4. Rigid duct insulation for exterior ductwork shall be polyisocyanurate closed-cell foam board.

2.2 FIBERGLASS ACCESSORY MATERIALS

- A. Vapor Barrier Mastic: Childers products CP30 or equal.
- B. Finishing Cement: Johns-Manville No. 375 or equal.
- C. Duct Tape: Hardcast Inc. PS-S poly type tape, No. P301.
- D. Staples: Stainless Steel.
- E. Blanket: Fiberglass Cloth.

2.3 ELASTOMERIC INSULATION AND LINING

- A. General: Insulation material shall be a flexible, closed-cell or conformable, elastomeric insulation in sheet form. Insulation shall conform to ASTM C534, Grade 1 Type II, "Specification for preformed elastomeric cellular thermal insulation in sheet and tubular form".
- B. The insulation closed-cell structure shall prevent moisture from wicking and effectively retard heat gain. The insulation product line shall have the capability for a conformable cell structure, allowing it to be bent on a coil line brake for tight fit in the corners.
- C. Insulation materials shall be manufactured without the use of CFC's, HFC's or HCFC's. They shall also be formaldehyde-free, low VOCs, fiber free, dust free and resist mold and mildew.
- D. The insulation material shall meet the requirements as defined in ASTM C1534, Standard "Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Adsorbing Liner for Duct Systems".
- E. Materials 2" thickness and below, shall have a flame spread index of less than 25 and a smoke developed index of less than 50 when tested in accordance with ASTM E 84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive and all materials shall pass simulated end-use fire tests.
- F. Materials shall have a maximum thermal conductivity of 0.25 Btu-in./h-ft' - °F at a 75°F mean temperature when tested in accordance with ASTM C177 or ASTM C518, latest revisions.
- G. Materials shall have a maximum water vapor transmission of 0.05 perm-inches when tested in accordance with ASTM E96, Procedure A, latest revision.
- H. Materials shall have a maximum water absorption rate of 0.2% (%by volume), when tested in accordance with ASTM C209.
- I. The material shall be manufactured under an independent third party supervision testing program covering the properties for fire performance, thermal conductivity and water vapor transmission.
- J. Materials must be approved for air plenums.
- K. Materials must meet NFPA 90A, NFPA 908 and UL 181 Class 1 specification. M. Materials must meet ASTM C 411. Materials to perform up to 250°F.
- L. Pertinent Duct Lining Specification Compliance.
 - 1. ASTM C1071 - Erosion Resistance.
 - 2. ASTM G21 - Fungi Resistance.
 - 3. ASTM C1338 - Fungi Resistance.
 - 4. ASTM G22 - Bacterial Resistance.
 - 5. ASTM C665 - Non Corrosiveness and no objectionable odors.
- M. Noise Reduction Coefficient:NRC rating 0.40 - Test Method ASTM C423 with ASTM E795 Type A Mounting. NRC of insulation used for lining shall be 0.60 per ASTM C423 with ASTM E795 Type A Mounting.

2.4 FIRE-RATED GREASE EXHAUST DUCT WRAP

- A. Flexible fire-resistant wrap consisting of inorganic fiber blanket encapsulated with scrim-reinforced foil. Wrap shall be 6 pcf or greater density. Product shall be listed with 2-hour fire rating and zero-clearance to combustibles, and shall be designed and listed for use on grease exhaust ductwork per ASTM E2336.

PART 3 EXECUTION

3.1 DUCT INSULATION

- A. General
- B. Interior Ductwork:
 - 1. Provide insulation for rectangular and round ducts of the flexible type where concealed, fibrous and cellular glass, minimum density 3/4 PCF with a factory Type-I jacket vapor-barrier jacket. Provide rigid type insulation on rectangular duct where exposed.
 - 2. Install duct insulation continuously through sleeves and prepared openings except fire wall penetrations. Terminate duct insulation at fire dampers and flexible connections. Vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation.
- C. Installation On Concealed Interior Duct:
 - 1. For rectangular, oval or round ducts, attach insulation by applying Class-2 adhesive around the entire perimeter of the duct in 6" wide strips on 12" centers.
 - 2. For rectangular and oval ducts, 24" and larger additionally secure insulation to bottom of ducts by the use of mechanical fasteners. Space fasteners on 18" centers and not more than 18" from duct corners.
 - 3. For rectangular, oval and round ducts, provide mechanical fasteners on sides of duct risers for all duct sizes. Space fasteners on 18" centers and not more than 18" from duct corners.
 - 4. Impale insulation on the mechanical fasteners where used and press thoroughly into the adhesive. Care shall be taken to insure vapor barrier jacket joints overlap 2". Do not compress the insulation to a thickness less than that specified. Carry insulation over standing seams and trapeze type duct hanger.
 - 5. Install self-locking washers where mechanical fasteners are used. Trim back and bend over the pin.
 - 6. Secure jacket overlaps under the overlap with Class-2 adhesive and staple on 4" centers. Coat staples and seams with a vapor barrier coating.
 - 7. Cover breaks in the jacket material with patches of the same material as the vapor barrier. Extend the patches not less than 2" beyond the break or penetration in all directions and secure with Class-2 adhesive and staples. Seal staples and joints with a brush coat of vapor barrier coating.
 - 8. At jacket penetrations such as hangers, thermometers, and damper operating rods, fill voids in the insulation and seal the penetration with a brush coat of vapor barrier coating.
 - 9. Seal and flash insulation terminations and pin punctures with a reinforced vapor barrier coating finish. Overlap the coating with the adjoining insulation and uninsulated surface 2". Extend pin puncture coatings 2" from the puncture in all directions.
 - 10. Where insulation standoff brackets occur, extend insulation under the bracket and the jacket terminated at the bracket.
- D. Rigid Insulation:
 - 1. For rectangular ducts, secure rigid insulation to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12" apart and not more than 3" from the

- edges of the insulation joints. Provide a minimum of two rows of fasteners for each side of duct 12" and larger. Provide one row for each side of duct less than 12".
2. Form duct insulation with minimum jacket seams, and in no case shall a jacket seam be allowed on or within 3" of the duct corner. Bring insulation up to standing seams, reinforcing, and other vertical projections and do not carry over. Make vapor barrier jacket continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, carry insulation and jacket over.
 3. Impale insulation on the fasteners install self-locking washers and trim and bend over the pin.
 4. Seal joints in the insulation jacket with a 4" wide strip of heat-activated tape, as recommended by the insulation manufacturer, with the same appearance as the vapor barrier jacket. Heat-activated tape shall be installed in accordance with the manufacturer's instructions.
 5. Cover breaks and ribs or standing seam penetrations in the jacket material with a patch of the same material as the jacket. Extend patches not less than 2" beyond the break or penetration and secure with Class-2 adhesive and staple. Seal staples and joints with a brush coat of vapor barrier coating. Repairs with heat-activated tape material are also acceptable.
 6. At jacket penetrations such as hangers, thermometers, and damper operating rods, fill the voids in the insulation and seal the penetrations with a brush coat of vapor barrier coating.
 7. Seal and flash insulation terminations and pin punctures with a reinforced vapor barrier coating finish. Overlap the coating over the adjoining insulation and uninsulated surface 2". Extend pin puncture coatings 2" from the puncture in all directions.

3.2 FLEXIBLE CELLULAR SHEET AND ROLL INSULATION

- A. Sheet Insulation shall be adhered directly to clean, oil-free surfaces with a full coverage of Manufacturer's recommended adhesives. Apply adhesives to both the surface of the insulation and the surface of the duct.
 1. Provide zero-VOC adhesive.
 2. Ambient temperature for applications is between 40 degrees F and 100 degrees F.
 3. The skin side (smooth side) shall be exposed to the air stream.
 4. Butt-edge seams shall be adhered using manufacturer's recommended Adhesive by the compression fit method to allow for expansion/contraction. Leave a 1/2" wide uncoated border at the butt edge seams on the duct surface and the insulation surface. Overlap the insulation 1/4" at the butt-edges and compress the edges into place. Apply adhesive and allow 48 hours for full cure prior to operating system.
 5. Length of duct should allow for reaching in to apply 100% pressure to all interior surfaces.
 6. Refer to the Manufacturer's installation instructions for additional information.

3.3 FLEXIBLE CELLULAR SELF-ADHERING INSULATION

- A. Apply sheet directly to a clean, dry, oil-free surface.
- B. Ambient temperature for application shall be per manufacturer's recommendations, generally between 40°F and 100°F.
- C. The skin side (smooth side) shall be exposed to the air stream.
- D. Install all sheet butt joints with a compression fit. Overlap the insulation 1/4" at the butt-edges and compress the edges into place. Leave 1/2" wide release liner border at the butt edge.
- E. Refer to the manufacturer's Installation Booklet for additional installation information.
- F. For Air Velocities above 4,000 FPM (20.3 m/second), provide metal nosing should be applied to every leading edge.

- G. Some duct liners may have different installation instructions. This includes specific duct liners for round and rectangular ducts. Conform to manufacturer's published installation instructions.

3.4 FIRE-RATED GREASE EXHAUST DUCT WRAP

- A. Install in strict accordance with manufacturer's installation instructions.
- B. Apply 2 layers of wrap product with manufacturer's required overlaps to create 2-hour rated grease duct wrap system.

3.5 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.7 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

END OF SECTION

SECTION 23 07 19

HVAC PIPING & EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. HVAC piping insulation, jackets and accessories for heating water systems.
- B. HVAC equipment insulation, jackets and accessories for all equipment not provided with factory insulation under Division 23.
- C. Rigid piping insulation.
- D. Flexible piping insulation.
- E. Equipment insulation.
- F. Underground piping insulation.
- G. Exterior piping insulation.

1.2 WORK INCLUDED

- A. Provide insulation on all new systems specified under Division 23 as follows:
 - 1. Heating water.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
 - 2. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - 3. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation
 - 4. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- B. National Insulation Contractors Association (NICA)
 - 1. National Commercial and Industrial Insulation Standards
- C. Washington Administrative Code (WAC)
 - 1. WSEC-C, Chapter 51-11C, State Building Code Adoption And Amendment of the 2012 Edition of the International Energy Conservation Code, Commercial

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 - 1. Product data.
 - 2. O&M data.
 - 3. Warranty information:
 - a. Manufacturer's warranty.
- C. LEED Submittals

1. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Materials and Resources Submittals:
 - 1) MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 - LEED Certification Procedures.
 - (a) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - c. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Rigid Piping:

1. Insulation shall be pre-formed fiberglass with heat resistance per ASTM C547. Density to be 3 to 5lbs/cubic foot and "K" value shall be 0.25 or less.
 2. Jacket shall be "all purpose" Foil-Scrim-Kraft (FSK) Type. Provide with 2" overlap. Water vapor transmission rate to be less than 0.02 perms.
 3. Provide final jacket of pre-formed plastic, similar to fitting covers.
- B. Flexible Piping:
1. Flexible elastomeric thermal insulation per ASTM C534. Provide with "K" value of 0.27 or less. Product shall be suitable for use within a temperature range of -70 degrees F to 220 degrees F. AP/Armaflex insulation system or approved equal.
- C. Fittings And Small Valves:
1. Insulation to be fiberglass blanket per ASTM C547. Density to be 3 to 5lbs/cubic foot and "K" value shall be 0.25 or less.
 2. Vapor barrier jacket to be pre-formed plastic valve and fitting covers.
- D. Valves Over 2" Pipe Diameter And Pumps: Use 1½" of fiberglass insulation, fully enclosed on all sides and edges within tight weave Alpha Matrix 1925 glass cloth. Attach Bergen hooks around edges of pad. Fit pad to valve with edges tightly butted and secure with copper wire laced between hooks.
- E. Equipment: Insulation shall be pre-formed fiberglass board with heat resistant binder per ASTM C547. Density to be 3 to 5lbs/cubic foot and "K" value shall be 0.25 or less.

2.2 ACCESSORIES

- A. Vapor Barrier Mastic: Childers products CP30 or equal.
- B. Finishing Cement: Johns-Manville No. 375 or equal.
- C. Duct Tape: Hardcast Inc. PS-S poly type tape No. P301.
- D. Elastomeric Adhesive: As recommended by elastomeric insulation manufacturer.
- E. Pipe Supports: In addition to the requirements of Section 2305 00 - Common Work Elements for HVAC, provide thermal hanger shield at all support points on insulated piping. Products shall be Pipe Shields, Inc., ITT, Grinnell or equal.
- F. Staples: Stainless Steel
- G. Blanket: Fiberglass Cloth

PART 3 EXECUTION

3.1 GENERAL

- A. Install all insulation in accordance with manufacturer's recommendations as specified and per NICA standards and guidelines.
- B. Apply insulating materials only after all surfaces are clean and dry. Piping and equipment shall be pressure tested and approved before installing insulation. Support pipes using a pipe shield under the insulated pipe. Space pipe supports and use shields of adequate area to prevent crushing of insulation.
- C. Install a vapor sealed jacket on insulation covering cold pipe equipment. Seal all joints and penetrations of the jacket to maintain a continuous vapor barrier. Make insulation continuous through all wall, ceiling, and floor openings.
- D. See Section 23 05 00 - Common Work Elements for HVAC, for pipe support instructions, especially as they pertain to the use of insulation shields.

3.2 PIPING INSULATION

- A. Pipe: Pre-formed fiberglass with all-service jacket. Seal with staples every 2" along entire length of wrap.
- B. Small Valves And Fittings: Wrap fiberglass blanket around valve or fitting to desired thickness. Secure blanket with clips. Place plastic jacket over blanket and secure in the middle and at both ends with tape. Staple each tape application to bind assembly together. Apply vapor barrier adhesive on top of staples. Seal ends. As an alternative, pre-formed fitting and valve insulation or mitered pipe insulation may be used. Secure with wire and finish with glass cloth embedded between two coats of mastic.
- C. Large Valves: Insulate as specified in Part 2 - Products.
- D. Maintain vapor barrier throughout entire length of piping system. Seal any exposed insulation with mastic or other suitable material.
- E. Pipe supports directly attached to cold piping shall be insulated to prevent condensation.

3.3 EQUIPMENT

- A. Tanks:
 - 1. Insulation to be 2' x 4' fiberglass board in the thickness required for the piping system.
 - 2. Wrap a number of long lengths of inner tube around the tank. Place boards under these bands so that they are held firmly in place. Boards to be put on the ends shall be cut to shape and held in place by stainless steel wire. These boards shall be put on the tank in a staggered manner. The boards around the perimeter shall then be secured to the tank using 1/2" wide stainless steel bands. There should be four bands for each board on the tank. The rubber bands then may be removed.
 - 3. Glass cloth shall be applied over a coat of insulation cement with another coat of insulation cement on top.
- B. Pumps: Insulate around pump bodies handling cold fluids (40 - 55 degrees) and hot fluids (over 100 degrees). Provide for easy removal for maintenance.

3.4 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.6 EXAMINATION

- A. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

END OF SECTION

SECTION 23 07 19
REFRIGERANT PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe insulation for refrigerant piping.

1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM E84 -Standard Test Method for Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.7 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 INSULATION

- A. Flexible elastomeric closed cell pipe insulation, thickness per WSEC-C, Armacell AP Armaflex or approved equal. Flame-spread rating of 25 or less when tested under the provisions of ASTM E84.

2.2 ADHESIVE

- A. Compatible with insulation, Armaflex 520 adhesive as manufactured by Armacell, Inc. or approved equal.

2.3 TAPES

- A. General: 1" minimum width.
- B. AP/Armaflex insulation tape or equal.

2.4 FINISHING MATERIALS

- A. WB/Armaflex Finish as manufactured by Armacell, Inc.

2.5 SEALER

- A. Commercially available latex caulk.

PART 3 EXECUTION

3.1 PIPE INSULATION

- A. Insulation thermal resistance per the WSEC and equipment manufacturer's requirements.
- B. Seal all joints and seams of Armaflex Insulations on pipes with 520 adhesive applied in accordance with manufacturer's instructions.
- C. Install Insulation by slipping complete sections over the open ends of piping or tubing. Seal butt joints.
 - 1. Note: Small amounts of powdered lubricant may enter open pipe or tubing. Where this condition is critical for refrigeration systems, plug open end of pipe or tubing before slipping on insulation.
- D. Install Insulation by slitting tubular sections and applying them around piping or tubing. Seal butt joints and slit seams.
- E. Install sheet around pipes larger than 5" IPS without stretching and seal longitudinal seams and end joints.
- F. At pipe hanger locations, insert wood blocks or cork stoppers between the hanger support saddle and the pipe to prevent insulation from being unduly compressed in accordance with manufacturer's instructions.

3.2 FITTING INSULATION

- A. Fabricate fittings covers from insulation according to the manufacturer's directions. Join slit seams and mitered joints with adhesive.

3.3 FINISHES – INDOOR PIPING

- A. No finish is required over concealed insulation indoors. Apply two coats of finish directly to insulation surface where exposed, consult with Architect on finish color.

3.4 FINISHES – OUTDOOR PIPING

- A. Apply two coats of manufacturer's standard weatherproof and UV resistant finish.
- B. Provide aluminum jacketing on all outdoor piping.

3.5 MISCELLANEOUS

- A. Cleaning: Clean area of all dirt caused by this operation and leave area clean and free of debris.
- B. Miscellaneous Work:
 - 1. Pipe fittings and connections shall be pressure tested before insulation is applied.
 - 2. All outdoor surfaces shall shed water and not permit formation of standing puddles.
 - 3. Where special corrosion-resistant coatings are specified for metal surfaces, they shall be compatible with adhesive.
 - 4. All piping, tubing and fittings shall be installed with a minimum spacing of 2" between parallel pipes, and with a minimum spacing of 1" between pipe and adjacent surfaces. (Pipe temperature below 0 degrees F require special spacing).
 - 5. Hangers and saddles shall be of sufficient size to support the pipe and insulation. Hangers and saddles must be positioned so that there is sufficient space allowed for full insulation thickness and supporting devices such as wood blocks and cork stoppers.

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

- A. See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.
- B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
 - 1. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.3 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
 - 2. Full as-built set of control drawings.
 - 3. Full as-built sequence of operations for each piece of equipment.
 - 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.
 - b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.
 - f. Air terminal unit tag ID.

- g. Heating and/or cooling valve tag ID.
 - h. Minimum air flow rate.
 - i. Maximum air flow rate.
- 5. Full print out of all schedules and set points after testing and acceptance of the system.
- 6. Full as-built print out of software program.
- 7. Electronic copy on disk of the entire program for this facility.
- 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
- 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
- 10. Control equipment component submittals, parts lists, etc.
- 11. Warranty requirements.
- 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
- 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Valves and valve actuators.
 - h. Dampers and damper actuators.
 - i. Program setups (software program printouts).
- D. Project Record Documents: See Section 01 78 00 for additional requirements.
 - 1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 - 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- E. Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:
 - 1. Follow the recommendations of ASHRAE Guideline 1.1.
 - 2. Control system manufacturer's recommended training.
 - 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- F. Training Manuals: See Section 01 79 00 for additional requirements.
 - 1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

- A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
- G. Provide temperature and pressure taps in accordance with Contract Documents.

3.2 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Provide two-way radios for use during the testing.
- D. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- E. Isolation Valve or System Valve Leak Check: For valves not by coils.
 - 1. With full pressure in the system, command valve closed.
 - 2. Use an ultra-sonic flow meter to detect flow or leakage.
- F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.

- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.
- F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
 - 1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
 - 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
 - 1. That all specified functions and features are set up, debugged and fully operable.
 - 2. That scheduling features are fully functional and setup, including holidays.
 - 3. That all graphic screens and value readouts are completed.
 - 4. Correct date and time setting in central computer.
 - 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 - 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
 - 7. Power failure and battery backup and power-up restart functions.
 - 8. Global commands features.
 - 9. Security and access codes.
 - 10. Occupant over-rides (manual, telephone, key, keypad, etc.).

11. O&M schedules and alarms.
 12. Occupancy sensors and controls.
 13. Fire alarm interlocks and response.
 14. Fire protection and suppression systems interfaces.
 15. That points that are monitored only, having no control function, are reporting properly to the control system.
 16. All control strategies and sequences not tested during controlled equipment testing.
 17. Trend logging and graphing features that are specified.
 18. Other integrated tests specified in Contract Documents
- H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 78 00 for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

- A. See Section 01 79 00 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
- E. TAB Review: Instruct Owner's personnel for minimum 4 hours, after completion of TAB, on the following:
 1. Review final TAB report, explaining the layout and meanings of each data type.
 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
 5. Other salient information that may be useful for facility operations, relative to TAB.
- F. HVAC Control System Training: Perform training in at least three phases:
 1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

- a. This training may be held on-site or at the manufacturer's facility.
 - b. If held off-site, the training may occur prior to final completion of the system installation.
 - c. For off-site training, Contractor shall pay expenses of up to two attendees.
 2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
 - a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
 - b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
 - c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
 - d. Every display screen, allowing time for questions.
 - e. Point database entry and modifications.
 3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.
 - G. Provide the services of manufacturer representatives to assist instructors where necessary.
 - H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
- END OF SECTION

SECTION – 23 08 00
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this section is to specify the Division 23 responsibilities and participation in the commissioning process. See Division 1, Section 019100, "Commissioning," for Contractor-related commissioning requirements.
 - 1. Organization of the commissioning program is primarily the responsibility of the Commissioning Authority. Execution of the program is primarily the responsibility of the Contractor with support from the Division 23 contractor for:
 - a. Testing and start-up of the mechanical equipment.
 - b. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 23 equipment and systems are fully operational and ready for functional testing.
 - c. Providing qualified personnel to assist the Commissioning Authority with functional testing to verify equipment/system performance.
 - d. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
 - e. Providing training for the systems specified in Division 23 with coordination of Owner by the Commissioning Authority.
- B. Division 23 Contractor shall cooperate with the Commissioning Authority in the following manner:
 - 1. Allow sufficient time before final completion dates so that test and balance, controls point-to-point checkout, and functional testing can be accomplished.
 - 2. Provide labor and material to make corrections when required without undue delay.
 - 3. Put all heating, ventilating, and air conditioning systems and equipment into full operation, and continue the operation of the same during each working day of commissioning.
- C. Related Sections
 - 1. Section 019100 – Commissioning
 - 2. Division 22 – Plumbing
 - 3. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
 - 4. Division 26 – Electrical

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Standard certified test equipment for commissioning will be provided by the Commissioning Authority.

- B. Proprietary test equipment required by the manufacturer shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

- A. Specific pre-commissioning responsibilities of Division 23 are as follows:
 - 1. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full-load and part-load performance, etc.
 - 2. Normal testing, adjusting and balancing services required to verify each system is operating at design capacities.
 - 3. Complete pre-functional test checklists for all equipment and systems to be commissioned.
 - 4. Demonstrate system readings as requested by the Commissioning Authority and adjust units to achieve specified operation.
 - 5. Factory start-up services for key equipment and systems specified in Division 23. The Division 23 Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Division 23 Contractor shall provide skilled technicians to start-up and debug all systems within the Division 23 work (particularly with controls equipment). These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed upon schedules, and of sufficient duration to complete the necessary tests, adjustments and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.
- C. Provide skilled technicians to manipulate the following equipment and systems to be commissioned for functional testing:
 - 1. Terminal cooling and heating system
 - 2. Automated control systems

3.3 WORK TO RESOLVE DEFICIENCIES

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet Acceptable Performance. Correction of work will be

completed under the direction of the Architect, with input from the Contractor, Equipment Supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer-of-Record will have final jurisdiction on the necessary work to be done to achieve performance and/or design intent.

3.4 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.
- B. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.5 TRAINING

- A. The Division 23 Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.

END OF SECTION 23 08 00

SECTION 23 08 10
REQUIREMENTS FOR STARTUP

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Provide startup and checkout procedures for all Plumbing and HVAC equipment in Divisions 22 and 23.
- B. Provide all commissioning documentation in order to comply with the "Systems Commissioning" requirements of the Washington State Energy Code, Commercial (Chapter 51-11C WAC, paragraph C408.2).

1.2 REFERENCE STANDARDS

- A. Washington Administrative Code (WAC):
 - 1. WAC 51-11C - Washington State Energy Code, Commercial (WSEC-C)
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
 - 1. SMACNA 1429 - HVAC Systems Commissioning Manual

1.3 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Startup Data
 - 1. Incomplete items list.
 - 2. Preliminary systems documentation
 - 3. Pre-start and startup checklists
 - 4. Functional performance checklists
 - 5. WSEC-C Commissioning checklist upon completion, along with the completed pre-start, startup and functional performance checklists.

1.4 QUALITY ASSURANCE

- A. Equipment startups shall be performed by manufacturer's authorized representatives.

1.5 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall prepare a complete list of all items that are not complete prior to notification of readiness for punchlist. This list shall include estimated date of Contractor completion for each item.
- B. The Contractor shall coordinate with the Owner for Owner's system operators & maintenance personnel to observe startup procedures.
- C. The following procedures shall be performed by the Contractor and their equipment supplier. Also, complete the "Commissioning Compliance Checklist" per the WSEC-C, and provide any information stipulated on that checklist.

3.2 PREPARATIONS

- A. Assemble four copies of the preliminary system documentation described below, and submit to the Architect along with the startup and checkout plan. Three copies will be returned to the Contractor.
 - 1. Startup Schedule, to be integrated with the Construction Schedule.
 - 2. List of equipment and systems for formal startup.
 - 3. List of sub-trades, suppliers and other Contractors who will be involved in the startup process.
 - 4. All submittal data and controls sequence descriptions needed to prepare startup and checkout checklists.

3.3 SYSTEM CHECKLISTS

- A. Prepare Pre-Start and Startup Checklists. These checklists shall be based on lists provided in Appendix B of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) "HVAC Systems Commissioning Manual". Level-1, "Basic Commissioning", which is the standard for this Contract. If applicable to the equipment and systems on this project, the SMACNA checklists may be used without modification. If not directly applicable, either modify a similar SMACNA checklist to suit the equipment or system under consideration, or create a new checklist. Any new or modified checklist must have the same level of checkout as the base SMACNA checklist. Pre-start and startup checklists shall include all manufacturer's recommended startup instructions. The manufacturer's instructions shall have priority over SMACNA checklist examples.
- B. Prepare functional performance checklists. These checklists shall be based lists provided in Appendix D of the SMACNA "HVAC Systems Commissioning Manual". Again, Level-1, "Basic Commissioning", is the Standard for this Contract. If applicable to the equipment and systems on this project, the SMACNA checklists may be used without modification. If not directly applicable, either modify a similar SMACNA checklist to suit the equipment or system under consideration, or create a new checklist. Any new or modified checklist must have the same level of checkout as the base SMACNA checklist. Functional performance checklists shall

include all manufacturer's recommended instructions for performance checkout. The manufacturer's instructions shall have priority over SMACNA checklist examples.

3.4 STARTUP AND CHECKOUT PLAN

- A. The startup and checkout plan is composed of the pre-start checklists, startup checklists and functional performance test checklists. The plan also includes the startup schedule, checkout schedule, list of sub-trades, suppliers and other contractors who will be involved in the startup and checkout process and all submittal data and controls sequence descriptions needed to prepare startup and checkout checklists.
- B. The startup and checkout plan shall be submitted to the Architect as soon as possible along with the preliminary system information. This will normally occur after the initial Controls Design Submittal (Shop Drawings) has been returned to the Contractor (all equipment has been normally submitted and approved by that time). No later than 3-months prior to substantial completion.

3.5 STARTUP AND CHECKOUT PROCEDURES

- A. Perform startup and checkout in accordance with the startup and checkout plan.
- B. The completed package shall be submitted for approval prior to acceptance of substantial completion. This package shall include:
 - 1. Two copies of the preliminary system information.
 - 2. Completed startup and checkout checklists.
- C. Provide an operations instruction and demonstration to the Owner's maintenance personnel in accordance with Chapter 6 of the SMACNA HVAC Systems Commissioning Manual.
- D. Refer to Section 23 08 00 for commissioning requirements.

3.6 BALANCING

- A. Balancing occurs after initial startup, and prior to functional testing. Deficiencies are identified and corrected, controls are calibrated, controls programming is initially set up and verified, and other startup and balancing tasks completed.
- B. Refer to Section 23 05 93 for testing and balancing procedures and requirements.

3.7 DOCUMENTATION

- A. Provide all documentation described in paragraph C408 of the Washington State Energy Code, Commercial.
- B. Provide completed startup and checkout checklists.

END OF SECTION

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. System description.
- B. Operator interface.
- C. Controllers.
- D. Power supplies and line filtering.
- E. System software.
- F. Controller software.
- G. Systems Integration.

1.2 REFERENCE STANDARDS

- A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2016.
- B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing
 - 1. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 - 1. Product data.
 - 2. Installer/contractor qualifications.
 - 3. Manufacturer qualifications.
 - 4. Shop drawings.
 - a. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.
 - 5. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.

- b. Commissioning report.
- 6. Project record documents.
 - a. Record actual locations of control components, including control units, thermostats, and sensors.
 - b. Revise shop drawings to reflect actual installation and operating sequences.
- 7. O&M data
 - a. As-built control drawings for all equipment.
 - b. As-built Network Communications Diagram.
 - c. General description and specifications for all components.
 - d. Completed Performance Verification sheets.
 - e. Completed Controller Checkout/Calibration Sheets.
- 8. Warranty information:
 - a. Manufacturer's warranty.
 - b. Manufacturer's extended warranty.
- 9. Training certificates.
- 10. Maintenance materials:
 - a. Contractor shall provide all programs, programming tools, licenses, access codes, and the like to the Owner to allow for future modifications to the BMS system by other contractors and/or vendors.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.
- E. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years.
- F. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.7 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between this Work and

that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features.

1.8 WARRANTY

- A. Correct defective Work within a five year period after Substantial Completion.
- B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.9 PERFORMANCE

- A. The system shall conform to the following:
 - 1. Graphic Display: The system shall display up to 4 graphics on a single screen with a minimum of (20) dynamic points per graphic. All current data shall be displayed within (10) seconds of the request.
 - 2. Graphic Refresh: The system shall update all dynamic points with current data within (10) seconds. Data refresh shall be automatic, without operator intervention.
 - 3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be (10) seconds. Analog objects shall start to adjust within (3) seconds.
 - 4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior (10) seconds.
 - 5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
 - 6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
 - 7. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every five (5) seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
 - 8. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within (5) seconds of each other.
 - 9. Reporting Accuracy: Listed below are minimum acceptable reporting accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
a. Space temperature	± 1 degrees F
b. Duct air temperature	± 2 degrees F
c. Outdoor air temperature	± 2 degrees F
d. Water temperature	± 1 degrees F
e. Relative humidity	± 2 percent RH
f. Water flow	± 5 percent of full scale
g. Air pressure (ducts)	± 0.1 "W.G.
h. Air pressure (space)	± 0.001 "W.G.
i. Water pressure	± 2 percent of full scale
j. Electrical Power	± 5 percent of reading
k. Measured Variable	Reported Accuracy
l. Space temperature	± 1 degrees F
m. Ducted air temperature	± 2 degrees F
n. Outdoor air temperature	± 2 degrees F
o. Water temperature	± 1 degrees F
p. Relative humidity	± 2 percent RH
q. Water flow	± 5 percent of full scale

- r. Air pressure (ducts) ± 0.1 "W.G.
- s. Air pressure (space) ± 0.001 "W.G.

PART 2 PRODUCTS

2.1 GENERAL

- A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a Building Level Controller (BLC), graphics and programming, and other control devices for a complete system as specified herein.
- B. The installed system shall provide secure strong password access to all features, functions and data contained in the overall BMS.

2.2 SYSTEM DESCRIPTION

- A. Work Included:
 - 1. Furnish all labor, materials and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only - refer to all included documentation for a complete description of work including, but not limited to, control schematics, points list, mechanical schedules, sequences of operation, and specification sections of the mechanical equipment to be controlled.
 - 2. Upgrade existing BMS to specified version.
 - 3. Integrate all points and components from existing BMS system into new BMS.
 - 4. Modify and expand existing BMS wiring as necessary for new BMS system connections.
- B. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- C. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- D. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, and actuators.
 - 1. Existing building LAN may be expanded/modified to accommodate BMS system as required.
- E. Controls for radiation, unit heaters, and the like.
- F. Controls for large equipment such as air handling units, heat pump units, and the like.
- G. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment, and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- H. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.
- I. All workstations, building controllers, application controllers, and input/output devices furnished in this section shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135, BACnet. Gateways may be used for communication to existing systems or to system installed under other sections.
 - 1. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
 - 2. The BMS server shall host all graphic files for the control system.
 - 3. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all

network management, operating system server, and software required for the ongoing maintenance and operation of the BMS.

4. All hardware licenses and certificates shall be stored on secure local hardware.

2.3 BMS SERVER HARDWARE

- A. Provide operator's workstation(s).
 1. Location(s): Building Maintenance Rm 124.
 2. Total quantity of operator's workstations: 1
- B. BMS Server Minimum Requirements
 1. Operating System: 64-bit; Windows 10 Professional.
 2. Processor: 2 GHz (or better), dual-core or quad-core processor, Intel Core i7 or higher.
 3. Memory: 32 GB or more - as needed to meet performance requirements.
 4. Hard Drive: 1000 GB minimum.
 5. Optical Drive: CD/DVD burner.
 6. Display: Video card and monitor capable of displaying 1080p resolution or greater. Monitor shall be 24" or larger.
 7. Network Support:
 - a. Ethernet: Ethernet adapter (10/100/1000 Mb with RJ-45 connector)
 - b. Wifi: Wireless N/AC
 8. USB Support: USB 3.0 (minimum), 3 ports (minimum).
 9. Peripherals:
 - a. Keyboard, bluetooth or wireless w/ USB adapter.
 - b. Mouse, bluetooth or wireless w/ USB adapter.
- C. Standard Client: The thin-client web browser BMS GUI shall be Microsoft Internet Explorer (10.0 or later) or equivalent running on Microsoft Windows 7+. No special software shall be required to be installed on the PCs used to access the BMS via a web browser.

2.4 BMS SERVER & WEB BROWSER GUI - SYSTEM OVERVIEW

- A. The BMS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BMS server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet (if requested by Owner).
- B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BMS via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Windows operating systems (Android, iOS). A single server license shall allow a minimum of 200 thin-client users.
- C. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
 1. Trending
 2. Scheduling
 3. Real time 'live' Graphic Programs
 4. Tree Navigation
 5. Parameter change of properties
 6. Set point adjustments
 7. Alarm / event information
 8. Execution of global commands

- D. Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
 - 1. Web Browsers for PCs: Only the current released browser (Explorer/Firefox/Chrome/Safari) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.

2.5 WEB BROWSER GRAPHICAL USER INTERFACE

- A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The web browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, and configuration menus for operator access.
- B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control privileges.
- C. Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control like Microsoft's Explorer program) and/or by selecting dynamic links to other system graphics. The navigation tree shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic.
- D. Data Displays:
 - 1. Data displays shall render all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings, and wiring diagrams from as-built drawings.
 - 2. Data displays shall render all data using iconic graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, trendlog, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user.
 - 3. Data display frame shall allow user to change all field-resident BMS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc., from any screen, no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
 - 4. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic.
 - 5. All displays and programming shall be generated and customized by the Controls Contractor. Systems requiring factory development of graphics or programming of DDC logic are specifically prohibited.
 - 6. BMS server shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Server shall include a library of equipment graphic components to assemble custom graphics. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.
 - 7. A navigation tree for building, equipment and system diagnostic centric display organization shall be available from data display view. The tree navigation contents shall be customizable on a per-user and per-group basis.

8. Each display may be protected from viewing unless operator credentials have the appropriate access level. An access level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.
 9. Data displays shall have the ability to link to content outside of the BMS. Such content shall include, but is not limited to launching external files in their native applications (for example, a Microsoft Word document).
 10. Data displays shall support:
 - a. Graphic items with custom geometry that offer both color gradient shading and variable opacity in scale to system variables and range setpoints.
 - b. Clear and custom geometry navigation buttons to provide intuitive navigation to system display or external URLs.
 - c. Graphic files in JPG, PNG, and GIF file types.
 - d. Viewing of 1,024 system data points in a single screen.
 - e. Customizable mouse-over information of graphic items.
 - f. Right click capability to directly access system functionality, such as Schedule, Trendlogs, and Alarms associated with a display object selected.
 11. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
 - a. Each piece of equipment monitored or controlled including each terminal unit.
 - b. Each building.
 - c. Each floor and zone controlled.
- E. Scheduling:
1. GUI shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily, with events being the highest.
 2. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
 3. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate access privileges.
 4. GUI shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting Schedule.
 5. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
 6. Schedule list shall show all schedules currently defined. This list shall include all standard, holiday and event schedules. In addition, user shall be able to select a list that shows all scheduled points and zones.
 7. Display of all three schedules must show all ON times for standard, holiday and event schedules in different colors on a given day. In addition, OFF times for each must also be shown in additional colors. User shall be able to select from standard calendar what days are to be scheduled and same display shall show all points and zones affected. User shall be able to set time for one day and select all days of the week that shall be affected as a recurrence of that same schedule for that given day.
 8. Any displayed data that is changeable by the operator may be selected using the right mouse button and the schedule shall then be selectable on the screen. Selection of the schedule using this method shall allow the viewing of the assigned schedule allow the point to be scheduled.

9. Schedule editor shall support the view of affected zones when adding or editing timed events of a schedule.
10. The web client shall have the ability to search a list of all scheduled points and zones to access the schedule calendar.
11. Schedule time blocks shall present schedule detail via mouse-over information.

F. Alarms:

1. BMS shall provide visual, printed, and email means of alarm indication. Printout of alarms shall be sent to the assigned terminal and port. Alarm notification can be filtered based on the User ID's authorization level.
2. Web client shall display a persistent alarm state for the system regardless of the data view including points in alarm but not acknowledged, and points that have gone into alarm and returned to normal without being acknowledged.
3. Alarm History shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the Server. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment, and identification of operator acknowledging alarm.
4. Alarm messages shall be in user-definable text (English or other specified language) and shall be delivered either to the operator's terminal, client or through remote communication using email (Authenticated SMTP supported).
5. GUI shall allow for set up of alarms and shall walk user through all steps necessary for alarm generation. Alarm creation may be started by right-clicking on value displayed on graphic and then selecting Alarm setup.
6. Web client shall support color-coded indication of current alarms as follows:
 - a. Red indicator shows number of active alarms that have not been acknowledged.
 - b. Yellow indicator shows number of alarms that are still active but have been acknowledged.
 - c. Blue indicator shows number of alarms that have returned to normal but have not been acknowledged.
 - d. Color-coded indicators, when selected by the user, navigate to a pre-filtered view of alarm history.
 - e. Alarm history can be filtered by color-coded indicator states.
7. Alarm annunciation includes navigation link to a user-selected display or URL.
8. Any displayed data that is changeable by the operator may be selected using the right mouse button and the alarm shall then be selectable on the screen. Selection of the alarm using this method shall allow the viewing of the alarm history or allow the creation of a new alarm.

G. Trends:

1. BMS shall periodically gather historically recorded data stored in the building controllers and store the information in the system database. Stored records shall be appended with new sample data, allowing records to be accumulated. Systems that write over stored records shall not be allowed unless limited file size is specified. All trendlog records shall be displayed in standard engineering units.
2. System shall be capable of trending on an interval determined by a polling rate, or change-of-value.
3. GUI shall be able to add and edit trendlogs and the setup information. This includes the information to be logged as well as the interval at which it is to be logged. All operations shall be password protected. Viewing may be accessed directly from any and all graphics on which a trended object is displayed.
4. BMS shall include a Trendlog Wizard for setup of multiple trend logs simultaneously. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right-clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.

5. BMS shall be capable of using Microsoft SQL as the system database.
 6. Any displayed data that is changeable by the operator may be selected using the right mouse button and the trendlog shall then be selectable from a menu on the screen. Selection of the trendlog using this method shall allow the viewing of the trendlog data in the DataViewer.
 7. DataViewer shall provide:
 - a. Software that is capable of graphing the trend-logged object data shall be included.
 - b. Access and ability to create, edit and view are restricted to users by user account credentials
 - c. Specific and repeatable URL defines the trendlog(s) views for browser bookmarking and email compatibility.
 - d. Call out of trendlog value at intersection of trend line and mouse-over vertical axis.
 - e. Trendlog or Energy log and companion logs can be configured to display on one of two independent vertical scales embedded in the display.
 - f. Click zoom for control of data set viewed along either graph axis.
 - g. User-specifiable start and end dates as well as a fast scroll features that supports click zoom of macro scale view of the data for quickly finding data set based on visual signature.
 - h. User export of the viewed data set to MS Excel.
 - i. Web browser-based help.
 - j. Optional min/max ranges (Upper Control Limits, Lower Control Limits) for each value.
- H. Energy Logs:
1. BMS shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
 2. All data shall be stored in database file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
 3. BMS operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
 4. BMS shall display data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format, the user shall be able to select a specific period of data to view.
 5. Web client shall display data in tabular format and graphical format. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format, the user shall be able to select a specific period of data to view.
- I. Demand Limiting:
1. BMS shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator-selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
 2. Binary shedding shall include minimum of five (5) priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one, the loads shall be shed/restored in a "first off-first on" mode, and in the other the loads are just shed/restored in a "first off-last on" (linear) fashion.
 3. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.

4. BMS shall be able to display the status of each and every load shed program. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.
- J. Tenant Activity:
1. BMS shall include program that monitors after-hours overrides by tenants, logs that data, and generates a bill based on usage and rate charged for each tenant space. Tenant Activity program shall be able to assign multiple zones, from a list of every zone connected to system, to a particular tenant. Every zone is monitored for after-hours override usage and that data logged in the Server. Operator may then generate a bill based on the usage for each tenant and the rate charged for any overtime use.
 2. Configuration shall include entry of the following information for use in logging and billing:
 - a. Tenant's contact name and address
 - b. One or multiple tenant zones that make up a total tenant space, including a separate billing rate for each separate zone
 - c. Minimum and maximum values an event duration and event limit
 - d. Property management information
 - e. Overall billing rate
 - f. Seasonal adjustments or surcharge to billing rate
 - g. Billing notification type including, but not limited to printer, file and email
 - h. Billing form template
 3. Logging shall include recording the following information for each and every tenant event:
 - a. Zone description
 - b. Time the event begins
 - c. Total override time
 - d. Limits shall be applied to override time
 4. A tenant bill shall be generated for a specific period using all the entered configuration data and the logged data. User with appropriate security level shall be able to view and override billing information. User shall be able to select a billing period to view and be able to delete events from bill.
- K. Reports
1. BMS shall be capable of periodically producing reports of trendlogs, alarm history, tenant activities, device summary, energy logs, and override points. The frequency, content, and delivery are to be user adjustable.
 2. All reports shall be capable of being delivered in multiple formats including text- and comma-separated value (CSV) files. The files can be printed, emailed, or saved to a folder, either on the server hard drive or on any network drive location.
- L. User Access:
1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
 2. BMS shall provide security for a minimum of 200 users. Each user shall have an individual User ID, User Name, and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID, User Name, and Password shall be shall support a minimum of 40 characters. All user information and passwords shall be stored in an encrypted form.
 3. Each user shall be allowed individual assignment of only those control functions, menu items, navigation tree, and user-specific system start display, as well as restricted access to discrete BACnet devices to which that user requires access.
 4. All passwords, user names, and access assignments shall be adjustable via Server software. Password shall be adjustable via the web client.
 5. Users shall also have a set access level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct access levels for assignment to users.

6. The BMS shall include an Auto Logout feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.
7. The system shall permit the assignment of an effective date range, as well as an effective time of day, that the User IDs are permitted to authenticate.
8. An Operator Activity Log that tracks all operator changes and activities shall be included with the software. System shall track what is changed in the system, who performed this change, date and time of system activity, and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation. Operator shall be able to print the Operator Activity Log display.
9. Log shall be gathered and archived to a hard drive on the Server as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
10. System shall have the option to require user comment recording in the Operator Activity Log upon any system point change.
11. Operator Activity log shall be accessible via the Web Client for viewing, sorting, filtering, and Printing.

2.6 BUILDING LEVEL CONTROLLER (BLC)

- A. These controllers are designed to manage communications between the programmable equipment controllers (PEC) and application specific controllers (ASC) which are connected to its communications trunks, manage communications between itself and other building level controllers (BLC) and with any operator workstations (OWS) that are part of the BMS, and perform control and operating strategies for the system based on information from any controller connected to the BMS.
- B. The BLC shall be compatible with multiple communications protocols, without the use of external gateway devices, including (at a minimum): BACnet (MS/TP, Ethernet, and IP), Modbus (RTU and TCP/IP), LON, SNMP, and OBIX.
- C. The controllers shall be fully programmable and scalable such that the number of trunks and protocols may be selectable to meet the unique requirements of the facility it shall control.
- D. The controllers shall be capable of peer-to-peer communications with other BLCs and with any OWS connected to the BMS, whether the OWS is directly connected or connected via the Internet.
- E. The BLC shall be provided with a device count capacity license that supports all devices to be integrated into the BMS <with additional capacity for <#> devices>.
- F. The BLC shall be capable of communicating with all equipment specified in these project documents. All BLCs shall be BTL listed native BACnet devices and must be capable of functioning as a BACnet Broadcast Management Device (BBMD) with a minimum of 128 entries and 3,000 subnets.
- G. The BLC shall be capable of executing application control programs to provide:
 1. Calendar functions - minimum of 380 BACnet Calendar Objects
 2. Scheduling - minimum of 380 BACnet Schedule Objects
 3. Trending - minimum of 2,000 objects at 15-minute intervals
 4. Alarm monitoring and routing - minimum capacity for 2,000 alarm setups
 5. Demand limiting - capable of shedding up to 1,200 loads
 6. Time synchronization
 7. Tenant activity logging - minimum of 380 zones
 8. Network management functions for all BLC, PEC and ASC based devices
- H. The BLC shall provide the following hardware features as a minimum:
 1. Two 10/100 Mbps Ethernet ports

2. Two Isolated RS-485 ports
 3. 1 GB RAM
 4. Two integral Universal Inputs (configurable for thermistor, 0-10V, 4-20mA, or dry contact signals).
 5. 0-122°F Ambient Operating Temperature
 6. Option cards or expansion modules for necessary communication ports/protocols
 7. 24 VAC/DC Global Power Supply
 8. MicroSD Memory Card for onboard license
- I. The BLC shall provide alarm recognition, storage, routing, and management to supplement distributed capabilities of equipment or application specific controllers.
- J. The BLC shall be able to route any alarm condition to any defined user location whether connected to a local network or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - a. Alarm
 - b. Return to normal
 - c. To default
 2. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text
 - b. Email of complete alarm message to multiple recipients
 - c. Graphics with flashing alarm object(s)
 3. The following shall be recorded by the BLC for each alarm (at a minimum):
 - a. Time and date
 - b. Equipment (air handler #, access way, etc.)
 - c. Acknowledge time, date, and user who issued acknowledgement

2.7 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

- A. Provide one or more native BACnet application controllers for each piece of HVAC equipment or system that adequately supports all control devices required for unit / system operation and/or specified in the project documents. All controllers shall interface to BLC through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP. No gateways shall be used. Controllers shall include input, output, and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation. No auxiliary or non-BACnet controllers shall be used and all PECs shall be BTL listed.
- B. All PECs shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.
- C. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- D. All PECs shall be selected to provide sufficient Inputs/Outputs for each application. PECs shall support the following:
1. Dry contact digital inputs
 2. Pulse inputs
 3. Analog inputs w/ 10-bit resolution (configurable as 0-5VDC, 4-20mA, or thermistor)
 4. Analog outputs (configurable as 0-10V or 0-20mA)
 5. Digital / binary 24VAC triac outputs
 6. One integral 24VDC, 100mA power supply for auxiliary devices
 7. Communications for intelligent space sensor
- E. PECs may utilize expansion modules to support additional I/O requirements as needed for larger applications (e.g. central plants).

- F. PECs shall support at minimum the following control techniques:
 - 1. General-purpose control loops that can incorporate demand control and setpoint reset strategies.
 - 2. General-purpose, non-linear control loops.
 - 3. Start/stop Loops.
 - 4. If/Then/Else logic loops.
 - 5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV).
- G. PECs used for central plant applications shall additionally include the following features:
 - 1. Hand-Off-Auto (HOA) switches with status indicator lights for all outputs.
 - 2. Real time clock with battery backup and time-based scheduling capabilities.
 - 3. Onboard scheduling, logging, and alarm generation that will continue to function upon loss of communications with the BLC.

2.8 APPLICATION SPECIFIC CONTROLLER (ASC)

- A. Provide one native BACnet application controllers for each piece of unitary HVAC equipment that adequately supports all control devices required for unit operation and/or specified in the project documents. All controllers shall interface to BLC through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output, and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation. No auxiliary or non-BACnet controllers shall be used and all ASCs shall be BTL listed.
- B. ASCs shall be fully programmable for the specific application with data stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained. Controllers with factory-programming that cannot be modified in the field shall not be allowed. ASCs shall at all times maintain their certification.
- C. The ASCs shall provide LED indication of communication and controller performance to the technician, without cover removal.
- D. All ASCs shall be selected to provide sufficient Inputs/Outputs for each application. ASCs shall support the following:
 - 1. Dry contact digital inputs
 - 2. Analog inputs w/ 10-bit resolution (configurable as 0-5VDC, 4-20mA, or thermistor)
 - 3. Analog outputs (configurable as 0-10V or 0-20mA) if required for the application
 - 4. Digital / binary 24VAC triac outputs
 - 5. Communications for intelligent space sensor
- E. ASCs shall support general-purpose control loops that can incorporate demand control and setpoint reset strategies, as well as all logic required to meet the Sequence of Operations specified in the project documents.
- F. ASCs serving Variable Air Volume (VAV) Terminal Units shall have onboard airflow transducers for room-level pressure-independent VAV control. Flow sensors shall be pre-calibrated at the factory with calibration data stored in non-volatile memory. Calibration data shall be field adjustable to compensate for variations in unit type and installation.

2.9 ACTUATORS

- A. Electronic Actuators:
 - 1. Actuators shall be sized based on torque required for damper seal at maximum design conditions and valve close-off pressure for system design.
 - 2. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.

3. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
4. Actuators shall be electronically protected from overload throughout rotation.
5. Fail Safe Operation: Actuators serving HVAC equipment exposed to outside air shall incorporate a spring-return mechanism or electronic super capacitor for fail safe operation.
6. Power Requirements: 24Vac/dc
7. Temperature Rating: -22 to +122 degrees F
8. Control Signal: 0-10V modulating. Floating-point control shall be permissible for terminal units, zone dampers/valves, and unit heaters.
9. Manufacturer: Belimo or approved equal.

2.10 CONTROL VALVES

A. General Requirements:

1. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
2. Sizing:
 - a. Two-Position: Line size or size using a pressure differential of 1 psi.
 - b. Two-Way Modulating: 5 psid or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than 5 psid.
3. The control valve assembly shall be provided and delivered from a single manufacturer as a complete assembly.
4. The manufacturer shall warrant all components for a period of 5 years from the date of production.
5. Manufacturer: Belimo or approved.

B. Characterized Control Valves:

1. 3" and Smaller: Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL or stainless steel flow characterizing disc.
2. 2-1/2" through 6": GG25 cast iron body, ANSI 125, class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring package design, PTFE seats, and a stainless steel flow characterizing disc.
3. Valve assemblies shall be maintenance free.

C. Globe Valves:

1. Two- and three-way globe valves shall be used only if characterized control valves do not fit the sizing criteria or application.
2. NPS 2 and Smaller: ANSI Class 250 bronze body, stainless steel stem, brass plug, bronze seat, and a TFE packing.
3. NPS 2-1/2 and Larger: ANSI Class 125 [250] cast iron body, stainless steel stem, bronze plug, bronze seat, and a TFE V-ring packing.
4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

D. Butterfly Valves - Resilient Seat:

1. Butterfly valves shall be used for isolation valve applications.
2. NPS 2 to 12: Valve body shall be full lugged ductile iron 200 psig body with a 304 stainless steel disc, EPDM seat, extended neck and shall meet ANSI Class 125/150 flange standards. Disc-to-stem connection shall utilize an internal spline. The shaft shall be supported at four locations by RPTFE bushings. A coated disc shell is not acceptable.
3. Sizing: Two-Position (on/off) butterfly valves shall be sized using the 90° Cv rating.
4. Flow Characteristics: Modified equal percentage, unidirectional dead end service.
5. Close-Off Pressure Rating: Bubble-tight shutoff (no leakage).

6. The combination of two 2-way butterfly valves in a tee configuration cross-linked to ensure proper flow orientation shall be permitted. The tee shall be constructed of cast iron/stainless steel.

2.11 OTHER CONTROL SYSTEM HARDWARE

A. Intelligent Room Sensors:

1. Room sensor shall include a backlit touchscreen LCD digital display, temperature sensor, humidity sensor, programmable status light indicator, and integral CO2 sensor where indicated in the design documents.
2. Temperature sensor shall be thermistor type with an accuracy of ± 0.5 degrees F at calibration point over a range of 32 to 140 degrees F or better.
3. Humidity sensor shall have an accuracy of $\pm 3\%$ from 10 to 90% relative humidity (RH) or better, non-condensing.
4. CO2 sensor (if applicable) shall have an accuracy of ± 30 ppm over the range of 0-5000 ppm or better. CO2 sensor shall utilize Automatic Baseline Correction.
5. Status light shall have a minimum of four (4) colors and be fully programmable.
6. Touchscreen display shall be able to indicate:
 - a. Room setpoint, room temperature, room humidity, and outside air temperature.
 - b. Lighting zone status with optional on/off control
 - c. Window shade status with option on/off control
 - d. Communication status
 - e. Override status with adjustable increments
 - f. Field service and balancing setpoints - password protected
7. Provide these sensors for the following area(s):
 - a. Staff areas
 - b. Lobby
 - c. Sparks Activity Area South
 - d. Sparks Office Entry

B. Room Temperature Sensors, No Display

1. Room sensor shall include a temperature sensor, setpoint adjustment functionality, and override pushbutton for after-hours usage (if enabled).
2. Temperature sensor shall be thermistor type with an accuracy of ± 0.5 degrees F at calibration point over a range of 32 to 140 degrees F or better.
3. Setpoint adjustment and override features shall be configurable from the BMS graphical user interface.
4. Provide these sensors for the following area(s):
 - a. Locker rooms
 - b. Mechanical rooms
 - c. Utility rooms
 - d. Storage rooms
 - e. Sparks Activity Area North
 - f. All locations where intelligent room sensors are not specified or indicated.

C. Duct-mounted and Outside Air Temperature Sensors: 10k-ohm thermistor temperature sensors with an accuracy of ± 0.36 degrees F. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of 32 to 140 degrees F. For all mixed air and preheat air applications, install bendable averaging duct sensors.

D. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degrees F (0 to 60 degrees C). Sensors shall be selected for wall, duct, or outdoor type installation as appropriate.

- E. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 75 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.
 - 1. Locations identified as CO2 alarms shall be provided with a horn/strobe unit with integrated push-to-silence switch, audible alarm horn, and visible alarm light.
- F. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- G. Differential Analog (duct) Static Pressure Transmitters: Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be plus or minus 1% of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube.
- H. Water Temperature Sensors:
 - 1. Thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
 - 2. Output Signal: 4-20 ma.
 - 3. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
- I. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed pressure tips.
- J. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.
- K. Low Air Temperature Sensors: Provide SPST type switch with 15 to 55 degrees F range and manual reset.
- L. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
- M. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.
- N. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.
- O. Fire Alarm System Interface:
 - 1. Fire alarm system and equipment smoke detectors shall be provided under Division 26.
 - 2. Fire/smoke dampers shall be provided under Division 23.
 - 3. BMS shall monitor a global fire alarm status signal via auxiliary relay contact at the Fire Alarm Control Panel. Coordinate with Division 26.

2.12 ENERGY METERING

A. Energy Metering Data:

1. The energy metering system shall monitor the following Total Building Energy Sources:
 - a. Electric
 - b. Propane gas
 - c. Site-Generated Renewable Energy
2. The energy metering system shall monitor the following End Use Categories:
 - a. HVAC System Energy
 - b. Water Heating Energy
 - c. Lighting Energy
 - d. Plug Load Energy
 - e. Process Load
3. Energy Metering Data Acquisition System
 - a. The energy meter data shall be stored for a minimum of 36 months.
 - b. The energy metering data acquisition system shall provide real-time energy consumption data and logged data for any hour, day, month, or year.
 - c. A readily accessible and visible display, or a web page, or other electronic document accessible to the building management or to a third-party energy data analysis service shall be provided in the building accessible by building operation and management personnel.
 - d. The energy display shall graphically provide the current energy consumption rate for each Total Building Energy Source and each End Use Category.
 - e. The energy display shall display the average and peak values for any day, week, or year.

B. Power Meters:

1. Provide electric utility meter 3 phase monitoring, diagnostics, and energy reports of consumption, demand, and power quality.
2. Provide installation of communication wiring between all monitored electrical meters and BMS network, per manufacturer's recommendations for installation.
3. Meter shall include input primary voltage of 120 to 480 VAC, Single and 3 phase monitoring, maximum primary current of 2,400 amps per phase, split core current transformers, and accuracy of IEC 62053-22 Class 0.5S, ANSI C12.20 0.5%.
4. Power monitoring data shall include:
 - a. kWH consumption.
 - b. kW demand.
 - c. VAR reactive power.
 - d. VA apparent power.
 - e. Power factor.
 - f. Average, minimum, and maximum demand.
 - g. Voltage, line to line and line to neutral.
 - h. Amps, average current.
 - i. kW demand (each phase).
 - j. Power factor (each phase).
 - k. Voltage (each phase).
 - l. Amps (each phase).
5. The power meter shall communicate using the BACnet MS/TP protocol at speeds from 9600 to 76,800 baud (no parity) or BACnet/IP protocol. The meter shall provide a BACnet Device object, a set of writable Analog Value objects for remote configuration, a set of Analog Input objects to provide access to scaled 32-bit measurement values and their unit types, and a set of Binary Input objects for indicating individual alarm conditions.
6. The meter shall be UL/CUL listed to the latest applicable safety standards.

7. The power meter shall accept either 0 to 0.333VAC or 0 to 1VAC input from up to three current transducers to 5,000 amps.
 8. The power meter shall be configurable for operation on Single Phase (AN or AB), Split Phase (ABN), Delta (ABC), and Wye (ABCN) systems.
 9. Manufacturers:
 - a. Veris
 - b. Setra
 - c. Or Approved
- C. Propane Meters:
1. Main Building Meter:
 - a. Utility meter to be provided by Division 22 contractor. Controls contractor shall purchase from the utility company a pulse transmitter device to be installed on the utility meter. Controls contractor shall incur all costs for installation.
 - b. The pulse transmitter shall be networked to the BMS.
 2. Propane Submeters:
 - a. General: Sensor shall be thermal mass flow meter complete with all hardware required for installation based on the specified pipe material. See drawings for locations of submeters.
 - b. For pipe sizes 1.5-inch diameter or larger, provide insertion type meter with hardware necessary to enable insertion and removal of the meter without system shutdown. Provide a flow conditioner if required to meet the manufacturer's minimum upstream straight pipe run requirement.
 - c. For pipe sizes less than 1.5-inch diameter, provide inline type meter with built-in flow conditioner.
 - d. Each flow meter shall be individually wet-calibrated and accurate to within $\pm 1\%$ of reading from 500-7000 SFPM and $\pm 2\%$ of reading from 100-500 SFPM.
 - e. Manufacturer and Model Number: ONICON model F-5000 or approved.

2.13 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
 2. Limit connected loads to 80 percent of rated capacity.
 3. Match DC power supply to current output and voltage requirements.
 4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
 5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
 6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
 7. Operational Ambient Conditions: 32 to 120 degrees F.
 8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
 9. Line voltage units UL recognized and CSA approved.
- B. Power Line Filtering:
1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
 2. Minimum surge protection attributes:
 - a. Dielectric strength of 1000 volts minimum.
 - b. Response time of 10 nanoseconds or less.
 - c. Transverse mode noise attenuation of 65 dB or greater.
 - d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.14 LOCAL AREA NETWORK (LAN)

- A. Provide communication between control units over local area network (LAN).
- B. LAN Capacity: Not less than 60 stations or nodes.
- C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- D. LAN system rating: Cat 6 (minimum).
- E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
- F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
- G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.15 BMS WIRING

- A. Provide new wiring for BMS system as required to connect new systems and components. All electrical control wiring to the control panels and equipment shall be the responsibility of the Control System Contractor.
- B. All wiring work shall comply with NFPA 70 (NEC) and Division 26 requirements.
- C. BMS wiring shall be run in rigid metallic conduit wherever possible.
 - 1. Provide flexible conduit for all final connections at equipment.

2.16 SYSTEMS INTEGRATION

- A. General: The following additional systems or devices shall be integrated into the BMS. Unless otherwise specified, all available points from the systems or devices shall be integrated into the BMS. All available command points shall be available on the BMS to send setpoints, commands, mode settings, etc. to the connected device/system.
- B. HVAC Systems
 - 1. VRF systems.
 - 2. DOAS/heat recovery units.
- C. Plumbing Systems
 - 1. Water heater WH-1.
 - 2. (4x) Domestic water meters.
 - 3. Irrigation deduct meter.
- D. Electrical Systems
 - 1. Lighting control panel.
 - 2. Fire alarm system alarm signal.

PART 3 EXECUTION

3.1 GENERAL:

- A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

- B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.
- C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.
- D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served.
- E. All room sensors shall be mounted at a height of 48 inches above finished floor, or as specified by the architect. Providing insulating back on sensors mounted on exterior walls.

3.2 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.3 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.
- C. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of NEC and Division 26.

3.5 WIRING

- A. All wiring work shall comply with NFPA 70 (NEC) and Division 26 requirements.
- B. Excess wire shall not be looped or coiled in the controller cabinet.
- C. Incorporate electrical noise suppression techniques in relay control circuits.
- D. There shall be no drilling on the controller cabinet after the controls are mounted inside.
- E. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.
- F. Use manufacturer-specified wire for all network connections.
- G. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.6 MANUFACTURER'S FIELD SERVICES

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.7 ACCEPTANCE TESTING

- A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. The Control System Contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.8 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.
- B. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- C. The Control System Contractor shall provide 16 total hours of comprehensive training in multiple sessions for system orientation, product maintenance and troubleshooting, and software operation. These classes are to be spread out during the 1st year warranty period, with one session to be conducted after final commissioning and an additional session to be conducted during the last month of one-year warranty period.

3.9 WARRANTY PERIOD SERVICES

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.
- C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor revisions to software during the first year warranty period shall be added to the systems, when they become available, at no additional cost. All BLC and BMS Servers are included in this coverage.
- D. Service Response: Warranty-related calls by the Owner shall be honored by end of next business day, Monday through Friday, 8AM-5PM.
- E. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

3.10 WARRANTY ACCESS

- A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period including remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) where allowable.

3.11 MAINTENANCE

- A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.
- B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

3.12 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.13 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 11 26

FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for propane gas piping systems.

1.2 REFERENCE STANDARDS

- A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.
- B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2011 (Addendum A, 2012).
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.
- F. ASME B31.1 - Power Piping; 2014.
- G. ASME B31.9 - Building Services Piping; 2014.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.
- M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).
- N. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
- P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- Q. NFPA 58 - Liquefied Petroleum Gas Code; 2020.

1.3 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.
- C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- D. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.
- E. Project Record Documents: Record actual locations of valves.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 PROPANE GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
 - 2. Joints: ASME B31.1, welded.

2.2 PROPANE GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: NFPA 58, threaded or welded to ASME B31.1.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) annealed.
 - 1. Fittings: ASME B16.26, cast bronze.
 - 2. Joints: Flared.

2.3 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.4 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.

2.5 BALL VALVES

- A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, ductile iron, or _____ body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, grooved, or _____ ends with union.

2.6 STRAINERS

- A. Size 2 inch and Under:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2.7 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

- A. Compliance Requirements:
 - 1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
 - 2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
- B. Materials in Contact With Gas:
 - 1. Housing: Aluminum, steel (free of non-ferrous metals).
 - 2. Seals and Diaphragms: NBR-based rubber.
- C. Maximum Inlet Operating Pressure: 10 psi.
 - 1. Appliance Regulator: 10 psi.
 - 2. Line Pressure Regulator: 10 psi.
- D. Maximum Body Pressure: 10 psi.
- E. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.

- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Section ____.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Provide support for utility meters in accordance with requirements of utility companies.
- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
 - 1. Painting of interior plumbing systems and components is specified in Section 09 91 23.
- N. Excavate in accordance with Section 31 23 16.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813.
- R. Sleeve pipes passing through partitions, walls and floors.
- S. Inserts:
- T. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - a. Painting of interior plumbing systems and components is specified in Section 09 91 23.

3.4 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.5 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and pipe fittings for the following systems:
 - 1. Copper systems.

1.2 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME)
 - 1. ASME B16.15 - Cast copper alloy threaded fittings.
 - 2. ASME B16.18 - Cast copper alloy solder joint pressure fittings.
 - 3. ASME B16.22 - Wrought copper and copper alloy solder joint pressure. fittings
 - 4. ASME B16.23 - Cast copper alloy solder joint drainage fittings.
 - 5. ASME B16.26 - Cast copper alloy fittings for flared copper tubes.
 - 6. ASME B16.29 - Wrought copper and wrought copper alloy solder joint drainage fittings.
- B. ASTM International (ASTM)
 - 1. ASTM A536 - Standard specification for ductile iron castings.
 - 2. ASTM B32 - Standard specification for solder metal.
 - 3. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
 - 4. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
 - 5. ASTM D2000 - Standard classification system for rubber products in automotive applications
- C. American Water Works Association (AWWA)
 - 1. AWS A5.8 - Specification for filler metals for brazing and braze welding.
- D. International Code Council (ICC)
 - 1. IMC - International Mechanical Code
- E. Washington Administrative Code, WAC 51-11
 - 1. WSEC-C, Chapter 51-11C, State Building Code Adoption And Amendment of the 2012 Edition of the International Energy Conservation Code, Commercial

1.3 SUBMITTALS

- A. See Division 1 for submittal procedures.
- B. Manufacturer's catalog data on pipe and fittings.
- C. Installation data if specialized requirements are present.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.5 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.

- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 COPPER PIPE AND FITTINGS

- A. Pipe: ASTM B88, Type-L.
- B. Fittings and flanges:
 - 1. Cast Bronze Fittings: ASME B16.15.
 - 2. Cast Copper Alloy Solder Joint Pressure Fittings: ASME B16.18.
 - 3. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings: ASME B16.22.
 - 4. Cast Copper Alloy Solder Joint Drainage Fittings (DWV): ASME B16.23.
 - 5. Cast Copper Alloy Fittings for Flared Copper Tubes: ASME B16.26.
 - 6. Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings: ASME B16.29.
- C. Alternate Fittings and Flanges:
 - 1. Rolled/grooved fittings.
 - a. Couplings: 200 PSI minimum joint working pressure, cast ductile iron housing conforming to ASTM A536. Gaskets for heating water or chilled water service, elastomer in accordance with ASTM D2000. Gaskets for heating water or chilled water service shall be elastomer per ASTM D2000. All grooved couplings shall be designed with angle bolt pads to provide rigid joint.
 - b. Flanges: 200 PSI minimum joint working pressure, cast ductile iron housing, suitable for bolting to ANSI Class-125 cast iron and 150 steel flanged components. Gasket material similar to coupling gasket material.
 - 2. T-drill mechanically extracted collars.
 - 3. Press fitting, Viega Rigid or Nibco Press System, conforming to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-ring for copper press fittings shall be EPDM.
- D. Solder: ASTM B32, lead free.
- E. Expansion Joints
 - 1. Lateral Motion: Braided stainless steel, flanged, 270 PSI working pressure at 70 degrees F, similar to Keflex KE-VIBES 4" KDCS-FLG.
 - 2. Axial Motion: Multiple bellows, flanged end, 150 PSI working pressure, stainless bellows, 2" travel, similar to Keflex Multi-flex expansion joint, Model M-15-00-P15-020, single unit.
 - 3. Flexible couplings may be used where required to accommodate thermal expansion and vibration movement. Provide a minimum of (3) flexible couplings in close proximity as recommended by manufacturer to attenuate equipment vibration at all rotating equipment, including pumps & chillers.

PART 3 EXECUTION

3.1 GENERAL PIPING INSTALLATION

- A. Install per the International Mechanical Code (IMC) and equipment manufacturer's instructions.
- B. Preparation:
 - 1. Clean off scale and dirt inside and outside before assembly. Cut pipes and tubes square and ream to remove all burrs.
 - 2. Cut pipe accurately to field measurements so work can be placed without springing or forcing.

C. Installation:

1. Install so piping is free to expand, provide for all expansion with offsets or loops where necessary. Branch connections shall have three elbow spring pieces to allow for expansion.
2. All changes in direction shall be made with fittings. Bushings shall not be used. All radius; shall be long radius.
3. Arrange piping so as not to interfere with access or removal of other equipment or devices, block access to doors, windows, manholes or other access openings.
4. Arrange piping to facilitate the removal of tube bundles, coils, etc. Provide unions ahead of screwed valves, traps or strainers on each side of each piece of equipment and wherever needed to dismantle piping.
5. All piping shall be properly pitched and graded to drain moisture and/or vent air.
6. Make reductions in pipe size using eccentric reducing fittings installed to provide drainage and venting.
7. Nipples shall be of the same material as pipe. Close nipples shall not be used.
8. Install pipe in neat and workmanlike manner, in accordance with best trade practice. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls unless otherwise shown. Where possible, group runs and rises.
9. Install concealed pipes in walls with clearance around piping to prevent contact with structure.
10. Pipes passing through concrete or masonry construction shall be fitted with sleeves. The inside diameter of pipe sleeves shall be at least 1/2" larger than the outside diameter of the pipe or pipe covering. See Section 23 05 00 - Common Work Elements for HVAC, for sleeve fabrication and installation instructions.
11. At all connections between ferrous and non-ferrous pipe:
 - a. Small Bore Pipe: Provide dielectric waterway fittings that maintain external electrical continuity while maintaining internal isolation. Fittings, and shall be listed by IAPMO/UPC.
 - b. Large Bore Pipe: Provide dielectric flanges.
12. Rated Penetration Seals: Provide per Chapter 15, "Firestop Protection", of the Uniform Plumbing Code.
13. Clean all new piping by flushing with water before permanent connections to new piping are made.
14. Install pipe hangers in an approved manner to maintain grade and to allow pipe movement due to expansion and contraction.
15. Provide pipe anchors where shown.
16. Install automatic air vents at all system high points. Provide a block or isolation valve in the air vent valve inlet line to allow the air vent to be isolated for cleaning and inspection. Pipe air vent outlets to the nearest drain.
17. Install drain valves at all system low points.
18. Pipe the discharge from relief valves to the nearest drain.
19. Provide detectable metallic underground tape for all buried piping. Install between 6"-12" above piping. Color scheme and text shall be appropriate to the associated system, and can be the manufacturer's standard color and description.

3.2 APPLICATIONS

A. Within Building Footprint:

1. Above grade, hydronic water systems: Copper

3.3 COPPER PIPING INSTALLATION

A. Copper Tube

1. Solder joints shall be made in accordance with the methods of ASTM B828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32. The joining of water supply piping shall be made with lead free solders and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2 % lead.
 2. Braze all below ground copper tube joints. All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.
- B. Copper Tube Extracted Joint: An extracted mechanical tee joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. The branch tube shall be notched for proper penetration into fitting to assure a free flow joint. Extracted joint shall be brazed using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.
- C. Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- D. Rolled/Grooved Connections: Install in accordance with manufacturer's instructions.
- E. Flared Joints: Flared joints for water pipe; shall be made by a tool designed for that operation.

3.4 PRESSURE TESTS

- A. Test systems at 1.2 to 1.5 times system operating pressure. Hold test for two-hours without loss of pressure.
- B. Tests may be witnessed by the Architect, and all defects corrected until no pressure loss is observed.

3.5 PIPE SUPPORTS

- A. Provide pipe supports per Section 23 05 00, "Common Work Results for HVAC".

3.6 PREPARATION FOR SERVICE

- A. General: New or repaired water systems shall be purged of deleterious materials prior to utilization. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet. Flush prior to each item of equipment (fan coils, heat pumps, and similar).

3.7 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.8 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Diaphragm Type Pre-Pressurized Expansion Tank.
- B. Air separators.
- C. Pressure reducing valves.
- D. Pressure relief valves.
- E. Combination pressure reducing and pressure relief valves.
- F. Circuit setter valves.
- G. Automatic air vents.
- H. Gauges, pressure and compound.
- I. Indicating thermometers.
- J. Thermowells
- K. Chemical Shot Feeder
- L. Strainers

1.2 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers (ASME)
 - 1. ASME BPVC SEC VIII - Pressure Vessels
 - 2. ASME B16.15 - Cast copper alloy threaded fittings.
 - 3. ASME B16.3 - Malleable iron threaded fittings.
 - 4. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 23 Metric/Inch Standard
 - 5. ASME B16.18 - Cast copper alloy solder joint pressure fittings.
 - 6. ASME B16.22 - Wrought copper and copper alloy solder joint pressure. fittings
 - 7. ASME B16.23 - Cast copper alloy solder joint drainage fittings.
 - 8. ASME B16.26 - Cast copper alloy fittings for flared copper tubes.
 - 9. ASME B16.29 - Wrought copper and wrought copper alloy solder joint drainage fittings.
 - 10. ASME B40.100 - Pressure Gauges and Gauge Attachments
 - 11. ASME SA 193 - Studs and Bolts
 - 12. ASME SA516 - Normalized Steel Plate
- B. ASTM International (ASTM)
 - 1. ASTM A53 - Standard specification for pipe, steel, black and hot-dipped, zinc-coated, welded and seamless.
 - 2. ASTM A536 - Standard specification for ductile iron castings.
 - 3. ASTM A47 - Standard specification for ferritic malleable iron castings.
 - 4. ASTM A105N - Standard specification for carbon steel forgings for piping applications
 - 5. ASTM A126 - Standard specification for gray Iron castings for valves, flanges, and pipe fittings.
 - 6. ASTM A234 - Standard specification for piping fittings of wrought carbon steel and alloy steel for moderate and high temperature service.
 - 7. ASTM A536 - Standard Specification for Ductile Iron Castings
 - 8. ASTM B32 - Standard specification for solder metal.

- 9. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
- C. American Water Works Association (AWWA)
 - 1. AWS A5.8 - Specification for filler metals for brazing and braze welding.
- D. International Code Council (ICC)
 - 1. IMC – International Mechanical Code

1.3

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.6 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM SPECIALTIES

- A. Diaphragm Type Pre-Pressurized Expansion Tank: ASME Pressure Vessel Code Construction for 861 kPa (125 PSIG) working pressure, welded steel shell, rust proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 PSIG).
- B. Air Separators:
 - 1. Tank Type Cyclone Style: Separation tank shall be steel, constructed, tested and stamped in accordance with ASME BPV VIII Division 1 for a working pressure of 125 PSIG. The

flow through the air separator shall be as indicated on the Drawings. Air separator connections shall be line size. Reducers shall not be used at tank connections.

- C. Pressure Reducing Valves: Pressure reducing portion of valve shall be a type that will not stick nor allow pressure to build up on the low side. The valve shall be set to maintain a terminal pressure approximately 5 PSI in excess of the static head on the system and shall operate within a 20 PSI variation regardless of initial pressure and without objectionable noise under any condition of operation.
- D. Pressure Relief Valves: Pressure relief valves shall be provided as indicated on the Drawings. Pressure relief valves shall be provided in accordance with ASME BPV VIII, Division 1, with the aggregate relieving capacity not less than that specified in the foregoing code.
- E. Combination Pressure Reducing And Relief Valves: Combination pressure reducing and relief valves may be substituted for separate valves. Combination valves shall be similar in performance and construction to the individually separately components specified herein. Valves characteristics shall be similar to Bell & Gossett Model F-3, 1/2" dual-unit, with fast-fill feature.
- F. Circuit Setter Valves
 - 1. 1/2" through 2"
 - a. The balancing valves shall be wye-pattern globe style design and all metal parts of nonferrous, pressure die cast, nonporous Ametal or bronze. Each valve shall provide four (4) functions: (1) Precision flow measurement, (2) Precision flow balancing, (3) Shut-off feature, eliminating the need of an additional isolation valve.
 - b. These valves shall have eight (8), twelve (12) or sixteen (16) 360° adjustment turns of the handwheel for precise setting with hidden memory feature to program the valve with precision tamper-proof balancing setting. Handwheel shall have digital readout. The handwheel can be installed in any position without affecting performance.
 - c. Valve shall be rated for 300 psi/2065 kPa, wye-pattern, globe type with soldered or threaded ends, non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.
 - d. Union Port Fitting: Threaded end terminal hook-up with manual air-vent port. Forged brass union with EPDM O-ring.
 - e. Test Ports: Self-sealing with EPDM seals.
 - f. Valves shall be Victaulic/Tour and Andersson STAD or STAS series, Armstrong CBV series, or approved equal.
 - 2. 2-1/2" through 12"
 - a. The balancing valves shall be wye-pattern globe style design with ductile iron body all other wetted parts of nonferrous, pressure die cast Ametal, bronze, or stainless steel. Each valve shall provide three (3) functions: (1) Precision flow measurement, (2) Precision flow balancing, (3) Shut-off feature, eliminating the need of an additional isolation valve.
 - b. These valves shall have eight (8), twelve (12) or sixteen (16) 360° adjustment turns of the handwheel for precise setting with hidden memory feature to program the valve with precision tamper-proof balancing setting. Handwheel shall have digital readout. The handwheel can be installed in any position without affecting performance.
 - c. Valve shall be rated for 300 psi/2065 kPa, wye-pattern, globe type with flanged or grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM O-ring seals. 8, 12, 16, 20 or 22 turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.
 - d. Union Port Fitting: Threaded end terminal hook-up with manual air-vent port. Forged brass union with EPDM O-ring.
 - e. Test Ports: Self-sealing with EPDM seals.
 - f. Valves shall be Victaulic/Tour and Andersson STAF or STAG series, Armstrong CBV series, or approved equal.

- G. Automatic Air Vents: Air vents shall be rated for the pressure and temperatures of the system into which they are installed. Body and cover shall be cast iron or semi-steel with stainless steel or copper float and stainless steel or bronze internal parts. Provide an isolation valve between the air vent and the pipeline. Huffman No. 79 or approved equal.
- H. Gauges, Pressure and Compound
1. Stainless steel liquid filled gauges. 4" diameter. IP65 protection.
 2. Provide normal working range of 50 % full scale.
 3. Ambient Temperature Range: -40 degrees F to 140 degrees F.
 4. 316 stainless steel element.
 5. Laminated safety glass window.
 6. White aluminum dial with black lettering.
 7. Pressure Connection: 1/2".
 8. Case, Bezel Ring And Movement: 304 stainless steel.
 9. Provide piston snubber and isolation cock valve. Snubber shall be brass body with minimum pressure of 5000 PSI. Snubber shall include a piston that moves within a chamber. The action of the piston in the chamber provides damping for the gauge and protects the gauge from debris in the working fluid.
- I. Indicating Thermometers: Provide Thermowell sized for each thermometer (mercury is not acceptable) shall have a nominal scale diameter of 5". Construction shall be stainless steel case with molded glass cover, stainless steel stem and bulb. Stem shall be straight, length as required to fit well.
- J. Thermowells:
1. Thermowell shall have brass body and cap, and Nordel valve core material rated at 360 degrees F. Body may be either 1/4" size or 1/2" size. Thermowells shall be capable of admitting the stem of a stem type thermometer or pressure gauge without fluid leakage from the system. Thermowells shall be similar in characteristics to "Pete's Plug" or "Sisco P/T Plug."
 2. Provide one measuring kit as part of this Contract which includes the following:
 - a. Compartmentalized carrying case.
 - b. 3 1/2" dial face pressure gauge, 0 to 100 PSI, with calibration screw, surge protector, and adapters.
 - c. Testing thermometer, 25 to 125 degrees F range.
 - d. Testing thermometer, 0 to 220 degrees F range.
 - e. Gauge adapter.
- K. Chemical Shot Feeder: Provide a shot feeder as indicated. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings and piping. Materials of construction shall be compatible with the chemicals being used. Feeder shall be fabricated to withstand the temperatures and pressures of the system into which it is installed.
- L. Strainers
1. Basket or Y-Type. Tee type is acceptable for water service. Grooved end strainers shall be rated for 300 PSIG minimum working pressure.
 2. All Other Services: Rated, 861 kPa (125 PSIG) saturated steam.
 - a. 65mm (2 1/2") And Larger: Flanged, iron body.
 - b. 50mm (2") And Smaller: Cast iron or bronze.
 - c. 50mm (2") And Larger: Ductile iron with grooved connections, 304 stainless steel convoluted removable basket.
 3. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2 1/2 times pipe area, with perforations as follows:
 - a. 75mm (3") And Smaller: 20 mesh for steam and 1.1mm (0.045") diameter perforations for liquids.
 - b. 100mm (4") And Larger: 1.1mm (0.045") diameter perforations for steam and 3.2mm (0.125") diameter perforations for liquids.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- D. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- E. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

3.2 CIRCUIT SETTER VALVES

- A. Mechanical contractor and balancing contractor shall be trained on installation, connection, and balancing procedures by certified manufacturer's representative.
- B. Valves shall be provided with manufacturer's balancing instrument kit. Provide (1) set of all instruments per project to the Owner, including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 21 23 HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. In-line circulators.

1.2 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators; 2018.
- B. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 HVAC PUMPS - GENERAL

- A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.2 IN-LINE CIRCULATORS

- A. General: Pump shall be in-line circulator with integral VFD and sensors. Pump shall be Bell & Gossett EcoCirc XL or approved equal.
- B. Components
 - 1. The pumps shall be a wet rotor inline pump, in cast iron or lead free bronze body construction specifically designed for quiet operation. Suitable standard operations at 230°

- F and 175 PSIG working pressure. The pump internals shall be capable of being serviced without disturbing piping connections.
2. The pump internals shall be capable of being serviced without disturbing piping connections.
 3. Pump shall be equipped with a water-tight seal to prevent leakage.
 4. Pump volute shall be of a cast iron design for heating systems or lead free bronze for domestic water systems. The connection style on the cast iron and bronze pumps shall be flanged.
 5. Flange to Flange dimension shall be standard Bell & Gossett booster sizes such as 6-3/8", 8-1/2", 11-1/2", and 12". Flange dimensions shall be HVAC industry standard 2 or 4 bolts sizes.
 6. Motor shall be a synchronous, permanent-magnet (PM) motor and tested with the pump as one unit. Conventional induction motors will not be acceptable.
 7. Each motor shall have an Integrated Variable Frequency Drive tested as one unit by the manufacturer.
 8. Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
 9. Pump shall have MODBUS or BACnet connections built into the VFD as standard options.
 10. Analog inputs, such as 0-10V and 4-20mA, are standard inputs built into the VFD.
 11. Pumps shall be UL 778 listed and bear the UL Listed Mark for USA and Canada with on-board thermal overload protection.
 12. Pumps shall be UL 778 listed and bear the UL Listing Mark for USA and Canada with on-board thermal overload protection.
 13. Each pump shall be factory performance tested
 14. before shipment.
- C. Operating Modes
1. General: The pump shall be capable of the following operating modes using built-in sensors and integrated VFD.
 2. Proportional Pressure – The differential pressure will continuously increase or decrease along a linear curve based on the flow demand.
 3. Constant Pressure – The pump maintains a constant differential pressure set by the user at any flow demand until the maximum speed is reached.
 4. Constant Speed – The pump maintains a constant speed at any flow rate
 5. Night Set Back – The pump will recognize a 10°C water temperature reduction and will switch to nighttime operation.
 6. T-Constant – This control will use a PI algorithm to vary the speed of the pump in order to maintain a constant temperature of the fluid media.
 7. Delta-T Constant – This control mode will use a PI algorithm to vary the speed of the pump in order to maintain a constant differential temperature between the built-in temperature sensor and external temperature sensor.
 8. Delta-P-T – This control mode is paired with proportional or constant pressure mode. The nominal differential pressure setpoint will vary according to the fluid temperature.
 9. Delta-P-Delta-T – This control mode is paired with proportional or constant pressure mode. The nominal differential pressure setpoint will vary according to the differential temperature between the built-in temperature sensor and external temperature sensor.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
- C. Provide line-sized shut-off valve and strainer on pump suction.
- D. Provide line-sized shut-off valve and soft-seat check valve on pump discharge.
- E. Lubricate pumps before start-up.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 31 13.13
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Ductwork Requirements.
- B. Galvanized steel ductwork.
- C. Aluminum ductwork.
- D. Ductwork accessories.
- E. Kitchen hood ductwork
- F. Manufactured Duct Systems:
 - 1. Single wall spiral round ducts.
- G. Ductwork fabrication.
- H. Kitchen hood exhaust ductwork fabrication.

1.2 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. IMC – International Mechanical Code
- C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- F. SMACNA - Fibrous Glass Duct Construction Standards.
- G. SMACNA - HVAC Air Duct Leakage Test Manual.
- H. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- I. SMACNA - Seismic Restraint Manual Guidelines for Mechanical Systems.
- J. SMACNA - HVAC Systems Duct Design
- K. SMACNA - Fire Damper Guide
- L. SMACNA - Kitchen Ventilation Systems and food Service Equipment Fabrication and Installation guidelines
- M. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with SMACNA table of equivalent rectangular and round ducts (HVAC Systems Duct Design).

1.4 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.

- B. Required submittals:
 - 1. Product data.
 - a. Submit data for specialty duct connectors other than found in the SMACNA duct construction manual, turning vanes, and duct access panels.
 - b. Product and fabrication data for specialty ductwork such as double-wall or round acoustically lined duct.
 - 2. Installation instructions.
 - 3. Installer/contractor qualifications.
 - 4. Manufacturer qualifications.
 - 5. Shop drawings.
 - a. Provide factory engineered shop drawings for all manufactured duct systems.
 - b. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 - c. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
 - d. Fittings.
 - e. Reinforcing details and spacing.
 - f. Seam and joint construction details.
 - g. Penetrations through fire rated and other walls.
 - h. Terminal unit, coil, and humidifier installations.
 - i. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
 - 6. Test & inspection reports:
 - a. Commissioning report.
 - 7. Project record documents.
 - 8. O&M data
 - 9. Calculations:
 - a. Duct support and bracing calculations.
 - 10. Warranty information:
 - a. Manufacturer's warranty.
 - 11. Training certificates.
- C. LEED Submittals
 - 1. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - a. LEED Submittal Coversheet
 - b. Low-Emitting Materials Submittals:
 - 1) EQ Credit Low Emitting Materials: General Emissions Evaluation. Documentation certifying all paints and coatings, ceilings, flooring, and insulation products comply with current California Department Public Health Standard (CDPH) Method v1.1-2010 or later, in accordance with Section 01 35 15, LEED Certification Procedures.
 - 2) EQ Credit Low Emitting Materials: Additional VOC content requirements for wet-applied paints, and coatings including products applied onsite: Documentation of certification from the manufacturer that the product meets the applicable VOC limits listed in Section 01 35 15 - LEED Certification Procedures.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

- C. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- D. Construct ductwork to NFPA 90A standards, SMACNA duct construction standards and the codes in force in the Authority Having Jurisdiction..

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 for product storage and handling requirements.

1.7 CLOSEOUT REQUIREMENTS

- A. Refer to Division 1 for execution and closeout requirements.
- B. Refer to Division 1 for closeout submittal procedures.
- C. Refer to Division 1 for demonstration and training requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. See Division 1 for product requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 GENERAL

- A. Rectangular Ductwork
 - 1. Construction Standards - SMACNA References:
 - a. Fire Damper Guide for HVAC Systems.
 - b. HVAC Duct Construction Standards, Metal and Flexible.
 - 2. Fabricate in accordance with SMACNA references, NFPA 90A, and the International Mechanical Code.
- B. Round Ductwork
 - 1. Provide spiral duct where metallic ductwork is exposed.

2.2 GALVANIZED STEEL DUCTWORK

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Angles, bars and rods for support and reinforcement: Structural quality carbon steel, ASTM A36.

2.3 ALUMINUM DUCTWORK

- A. Aluminum for Ducts and Fittings: ASTM B209 (ASTM B209M); aluminum sheet, alloy 1100, 3003, 3003-H14, or 5052.
- B. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

2.4 STAINLESS STEEL DUCTWORK

- A. Stainless Steel for Ducts: ASTM A666, Type 304 or 316.

2.5 DUCTWORK ACCESSORIES

- A. Turning Vanes: Provide single vane type for vane lengths under 36", double vane type on vanes 36" in length and longer.
- B. Duct Lining:
 - 1. Refer to Specification Section 23 07 13 - Duct Insulation & Lining.
 - 2. Enlarge the sheetmetal portion to account for the lining. The duct dimension provided on the drawings is the interior dimension unless specifically noted otherwise on the drawings.
- C. Caulking and Sealing Compounds:
 - 1. Per the requirements of NFPA Standard 90A for flame spread rating and smoke emission.
 - 2. Thick consistency sealant similar and equal to Minnesota Mining EC-800 or Foster No. 30-02.
- D. Support Materials:
 - 1. Prefabricated clamps, supports and accessories: ITT, Grinnel or equal.
 - 2. Structural Steel: ASTM A36 or 316 stainless steel.
 - 3. Support materials for natatorium, pool mechanical room, and chemical storage room locations shall be suitable for those environments.

2.6 KITCHEN HOOD DUCTWORK

- A. Construction Standards: SMACNA Kitchen Ventilation systems and Food Service Equipment Fabrication and Installation Guidelines, and the IMC.
- B. Materials: 16 gauge steel or 18 gauge stainless steel.
- C. Access Doors: As required for inspection and cleanout.

2.7 FLEXIBLE DUCTWORK

- A. Construction Standards: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- B. Duct Material: Vinyl coated spring steel helix bonded to a vinyl coated fiberglass mesh liner wrapped with fiberglass wool insulation jacketed with a reinforced metalized mylar/neoprene laminate outer casing.

2.8 MISCELLANEOUS COMPONENTS

- A. Refer to Section 23 33 00 - Air Duct Accessories, for common components such as fire dampers, smoke dampers, combination fire/smoke dampers, backdraft dampers, volume control dampers, flexible duct connections, motorized dampers, duct test holes, and the like.

PART 3 EXECUTION

3.1 APPLICATIONS

- A. General use HVAC: Galvanized steel or Aluminum ductwork
- B. Shower rooms: Aluminum ductwork
- C. Kitchen hoods (grease): Galvanized steel or Stainless Steel ductwork

3.2 GENERAL

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive plus mechanical fasteners.
- E. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- K. At exterior wall louvers, provide sheet metal plenum with minimum 6" depth sized to match louver. Seal plenum to louver frame.
 - 1. Install dividers in plenums where multiple ducts connect to single louvers or continuous louver sections.
- L. Provide turning vanes at all mitered rectangular duct elbows or tees.
- M. Hangers and Supports:
 - 1. All ducts must be provided with hangers in sufficient number and at close enough centers to prevent any bending or sagging. Hanger spacing shall not exceed 8'.
 - 2. Ducts shall be supported either by rods or by applicable methods as shown in the SMACNA Duct Manual.
 - 3. Ducts shall be seismically braced in accordance with the SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems, Latest Edition.
- N. Control Damper Installation:
 - 1. Install control dampers provided by the Controls Contractor.
 - 2. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transition required to install dampers larger than duct size.
 - 3. Assemble multiple section dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

4. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
- O. Protection And Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by the Architect. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.3 STANDARD METALLIC DUCTWORK

- A. Fabrication (Rectangular Ductwork):
 1. The internal end of all slip joints shall be installed in the direction of airflow.
 2. Where the perimeter of duct does not exceed the width of the sheet, ducts shall be constructed with one longitudinal seam only.
 3. "Pittsburgh" type flat double lock longitudinal seams shall be used on all ducts in which the longest transverse dimension does not exceed 36".
 4. "Standing" seams of lock type, 1" high shall be used on all ducts with longest transverse dimension exceeding 36". All standing seams shall be punched.
 5. "Ductmate" style manufactured seam systems are acceptable.
 6. Elbows:
 - a. Wherever possible, elbows shall have a centerline radius equal to 1½ times the duct dimension in the plane of the turn.
 - b. Where space does not permit the above radius, or where square elbows are indicated on the Drawings, they must be equipped with special manufactured, factory built turning vanes.
 - c. Local shop fabricated turning vanes will not be acceptable
 7. Where transition pieces in the ducts occur, the slopes in the sides must be approximately one to five. Abrupt changes or offsets of any kind will not be permitted.
 8. No attempt is made to show on the drawings all offsets, which may be required. All offsets in ducts necessary for the installation, whether shown or not, shall be provided.
 9. Provide turning vanes for all mitered duct elbows unless specifically noted otherwise on the Drawings.
- B. Round ductwork fabrication: Fabricate and install per SMACNA Duct Construction Standards, Metal & Flexible, NFPA 90A, and the International Mechanical Code. Also comply with general criteria specified above for rectangular duct (installation of control dampers, protection and cleaning, etc.).

3.4 ACCESSORIES

- A. Install volume or splitter dampers as required at all branches in the ductwork.
- B. Provide remote operators for inaccessible dampers.
- C. Install access panels and doors air tight. Select and set hardware, latches, locks and gasket seals to suit operating pressure.
- D. Install flexible connections at fan or equipment outlets. Align duct and equipment flange to maintain a 1" minimum clear gap between the adjoining metal parts.
- E. Provide sheet metal sleeve around penetrations through walls or floors. Pack opening around duct with fiberglass and caulk with resilient caulking.
- F. Provide access doors for all fire dampers, smoke dampers, combination fire and smoke dampers, volume dampers, heaters, coils, and any other component which will require maintenance.

3.5 KITCHEN HOOD DUCTWORK

- A. Duct Construction per the IMC and SMACNA Kitchen equipment guide.
 - 1. Continuously welded, liquid-tight
 - 2. Access panels or doors as indicated or required for removal of grease build-up.
- B. Duct Installation: Provide per the IMC section 506, "Commercial Kitchen Hood Ventilation System Ducts and Exhaust Equipment".
- C. Provide testing of hood ductwork per IMC section 506, "Commercial Kitchen Hood Ventilation System Ducts and Exhaust Equipment".

3.6 FLEXIBLE DUCTWORK

- A. Installation:
 - 1. Install in accordance with SMACNA references and to NFPA 90A. Installation shall comply with UL 181 requirements.
 - 2. Length of flexible duct shall not exceed 6'.
 - 3. Connect to metal ducts with adhesive plus mechanical fasteners.
 - 4. Runs of flexible duct shall be as straight as possible to minimize pressure losses. Stretch duct to smooth out internal corrugations. Use long radius bends where possible.
 - 5. Flexible duct connection shall be made by sliding inner duct on sheet metal connector and applying two wraps of duct tape, taking care not to wrinkle tape. Slide a worm drive stainless steel band clamp over tape, cover and inner duct and secure screw clamp

3.7 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Provide duct cleaning for the following duct systems:
 - 1. All new duct systems.
- C. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.8 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.
- C. All paints and coatings, including accessories, applied on site must comply with the VOC limits, emissions testing, and Submittal requirements for IEQ Credit Low-Emitting Materials as specified in Section 01 35 15 - LEED Certification Procedures.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Combination fire and smoke dampers.
- D. Duct access doors.
- E. Duct test holes.
- F. Flexible duct connectors.
- G. Volume control dampers.
- H. Miscellaneous products:
 - 1. Duct opening closure film.

1.2 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.
 - 6. Maintenance materials:
 - a. Extra fusible links for combination fire smoke dampers and fire dampers: Two of each size/type used on project.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with radius blades attached to pivoting frame and bracket, aluminum construction, with worm drive mechanism with removable key operator.

2.2 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Access doors with sheet metal screw fasteners are not acceptable.

2.3 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- C. Maximum Installed Length: 8 inch.

2.4 MISCELLANEOUS PRODUCTS

- A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
 - 1. Thickness: 2 mils.
 - 2. High tack water based adhesive.
 - 3. UV stable light blue color.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- C. Demonstrate re-setting of fire dampers to Owner's representative.
- D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

3.3 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.4 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Inline centrifugal fans.
- B. Kitchen hood upblast roof exhausters.

1.2 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.
- H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
- I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.
- J. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fan Belts: One set for each individual fan.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Enclosed Safety Switches: Comply with NEMA 250.
- H. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.2 INLINE CENTRIFUGAL FANS

- A. Centrifugal Fan Unit: Direct driven with EC motor, galvanized steel housing, aluminum fan assembly, factory mounted & wired junction box, factory mounted & wired adjustable speed control.
 - 1. Provide with sloped filter box with MERV 13 filters.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

2.3 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

- A. Direct Drive Fan:
 - 1. Fan Wheel:
 - a. Type: Non-overloading, backward inclined centrifugal.
 - b. Material: Aluminum.
 - 2. Statically and dynamically balanced.
 - 3. Motors:
 - a. EC type.
 - b. Heavy duty ball bearing type.
 - c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
 - d. Fully accessible for maintenance.
 - 4. Housing:
 - a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
 - b. Rigid internal support structure.
 - c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
 - d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
 - e. Provide breather tube for fresh air motor cooling and wiring.
- B. Shafts and Bearings:
 - 1. Fan Shaft:

- a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
- 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. 100 percent factory tested.
- C. Disconnect Switches:
 - 1. Factory mounted and wired.
 - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Outdoor Locations: Type 3R.
 - 3. Positive electrical shutoff.
 - 4. Wired from fan motor to junction box installed within motor compartment.
- D. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.
- E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.
- F. Options/Accessories:
 - 1. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
 - 2. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
 - 3. Drain Connection:
 - a. Allows single-point drainage of grease, water, or other residues.
 - 4. Grease Trap:
 - a. Aluminum.
 - b. Includes drain connection.
 - c. Collects grease residue.
 - 5. Hinge Kit:
 - a. Hinges and restraint cables mounted to base (sleeve).
 - b. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
 - 6. External motor speed controllers for field mounting.
 - 7. Finishes:
 - a. Fan: AEP Span Zactique II finish to match AEP span metal roof. Division 23 contractor shall coordinate finish to match roofing system finish provided under Division 7.
 - b. Roof curb extension: AEP Span Zactique II finish to match AEP span metal roof. Division 23 contractor shall coordinate finish to match roofing system finish provided under Division 7.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Kitchen hood exhaust and makeup air fans: Interlock exhaust and makeup air fans with kitchen hood controls.

3.2 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Diffusers:
- B. Rectangular ceiling diffusers.
- C. Slot ceiling diffusers.
- D. Registers/grilles:
 - 1. Ceiling-mounted, egg crate exhaust and return register/grilles.
 - 2. Ceiling-mounted, exhaust and return register/grilles.
 - 3. Wall-mounted, supply register/grilles.
- E. Duct-mounted supply and return registers/louvers.
- F. Louvers:

1.2 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).
- C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - 3. Project record documents.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.

1.4 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 GENERAL

- A. Refer to schedule on drawings for product selections.
- B. Materials of construction & finishes shall be capable of withstanding environmental conditions where inlets & outlets are installed.
- C. Provide all mounting hardware required to install air inlets & outlets where shown on the drawings.

2.2 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and _____ diffuser to discharge air in 360 degree, one way, two way, three way, four way, and _____ pattern with sectorizing baffles where indicated.
- B. Frame: Provide surface mount, snap-in, inverted T-bar, spline, and _____ type. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Color: As indicated on drawings.
- D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and _____ volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, anti-smudging device, gaskets for surface mounted diffusers, and _____ with damper adjustable from diffuser face.

2.3 CEILING SLOT DIFFUSERS

- A. Type: Continuous 1/2 inch wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge; integral ceiling fire damper.
- B. Fabrication: Aluminum extrusions with factory clear lacquer finish.
- C. Color: As indicated on the drawings.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket, mitered end border.

2.4 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.
- B. Material: 22 gauge, 0.0299 inch.
- C. Color: As indicated on drawings.

2.5 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.

- C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- D. Color: As indicated on the drawings.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.6 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch, 1/2 by 1/2 by 1 inch, 1 by 1 by 1 inch, and _____ grid core.
- B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
- C. Color: As indicated on the drawings.
- D. Frame: 1-1/4 inch margin with countersunk screw mounting.
- E. Frame: Channel lay-in frame for suspended grid ceilings.
- F. Accessories: Provide integral, gang & face operated opposed blade damper, 2 inch filter frame, plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver, 90 degree duct elbow, etc., and _____.

2.7 LOUVERS

- A. Type: 4 inch deep frame with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over intake or exhaust end.
- B. Fabrication: 12 gage, 0.1046 inch thick extruded aluminum, welded assembly, with factory prime coat finish.
- C. Color: To be selected by Architect from manufacturer's standard range.
- D. Mounting: Furnish with exterior flat flange for installation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black.
 - 1. Refer to Section 09 91 23.

3.2 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 72 23

PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Energy recovery units.

1.2 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
- B. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2014.
- C. ASHRAE Std 84 - Method of Testing Air to Air Heat/Energy Exchangers; 2020.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.
- B. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.
- C. Manufacturer's Qualification Statement.
- D. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Firm regularly engaged in manufacturing energy recovery units.
 - 2. Products in satisfactory use in similar service for not less than five years.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store in manufacturer's unopened packaging.
- B. Store products to be installed indoors in dry, heated area.

1.6 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.

PART 2 PRODUCTS

2.1 ENERGY RECOVERY UNITS

A. General:

1. The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. The unit shall have factory installed inlet air thermistors, control board with functions for local, remote, and optional control modes.
2. The basis of design fresh air ventilation system(s) is the Trane/Mitsubishi Electric Lossnay total heat exchanger with outside air bypass damper and energy recovery ventilation.
3. The unit shall be equipped with data network control and be directly connectable to the communication control network serving other systems from this manufacturer.
4. ERV performance must be certified to ARI Standard 1060
5. ERV operating sound level shall not exceed 41 dB(A) as measured 59 in. under center of unit at maximum fan speed.

B. Unit Cabinet:

1. The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached

C. Blowers:

1. The unit shall be furnished with direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.
2. The blower motors shall be directly connected to the blower wheels and have permanently lubricated bearings.

D. Heat Exchanger

1. The enthalpic heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.
2. Basis of design heat exchanger does not require condensate drain. Contractor responsible for all additional costs relating to alternate brands which may require condensate drain connection.

E. Bypass Damper

1. The ERV shall have an automatic supply side by-pass damper to allow inbound ventilation air to by-pass the heat exchanger element when factory-installed thermistors measure outside ambient temperature being at least 7 degrees cooler than air returned from interlocked indoor units running in cooling mode.
2. The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to a mechanical damper flap to allow fresh air to bypass the element.

F. Filter:

1. The ERV shall be equipped with factory installed, washable air filters located at each intake face (both supply and exhaust sides) of the heat exchanger element to clean the air and prevent clogging.

G. Electrical:

1. The units will require a 208-230Volt, 1 Phase, 60Hz power supply.

H. Control:

1. ERV shall be capable of interlocked control with other systems by manufacturer. Communication must include MODE of interlocked indoor unit to allow benefit of proper operation of bypass damper

2. ERV control board shall allow independent control by contact closure from third-party sensor-driven controllers, switches, or timers.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.2 INSTALLATION

- A. Provide openings for suitable ductwork connection.

3.3 SYSTEM STARTUP

- A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.4 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.5 CLEANING

- A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 81 29

VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Variable refrigerant flow HVAC system includes:
 - 1. Outdoor/condensing units.
 - 2. Indoor/evaporator units.
 - 3. Branch circuit controller units.
 - 4. Branch selector units.
 - 5. Hydronic heat exchanger units.
 - 6. Refrigerant piping.
 - 7. Control panels.
 - 8. Control wiring.

1.2 RELATED REQUIREMENTS

- A. Section 23 08 00 - Commissioning of HVAC.

1.3 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ITS (DIR) - Directory of Listed Products; current edition.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:
 - 1. Outdoor/Central Units:
 - a. Refrigerant Type and Size of Charge.
 - b. Cooling Capacity: Btu/h.
 - c. Heating Capacity: Btu/h.
 - d. Cooling Input Power: Btu/h.
 - e. Heating Input Power: Btu/h.

- f. Operating Temperature Range, Cooling and Heating.
 - g. Air Flow: Cubic feet per minute.
 - h. Fan Curves.
 - i. External Static Pressure (ESP): Inches WG.
 - j. Sound Pressure Level: dB(A).
 - k. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP.
 - l. Weight and Dimensions.
 - m. Maximum number of indoor units that can be served.
 - n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.
 - o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.
 - p. Control Options.
 - 2. Indoor/Evaporator Units:
 - a. Cooling Capacity: Btu/h.
 - b. Heating Capacity: Btu/h.
 - c. Cooling Input Power: Btu/h.
 - d. Heating Input Power: Btu/h.
 - e. Air Flow: Cubic feet per minute.
 - f. Fan Curves.
 - g. External Static Pressure (ESP): Inches WG.
 - h. Sound Pressure level: dB(A).
 - i. Electrical Data:
 - 1) Maximum Circuit Amps (MCA).
 - 2) Maximum Fuse Amps (MFA).
 - 3) Maximum Starting Current (MSC).
 - 4) Full Load Amps (FLA).
 - 5) Total Over Current Amps (TOCA).
 - 6) Fan Motor: HP.
 - j. Maximum Lift of Built-in Condensate Pump.
 - k. Weight and Dimensions.
 - l. Control Options.
 - 3. Control Panels: Complete description of options, control points, zones/groups.
- C. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
- 1. Detailed piping diagrams, with branch balancing devices.
 - 2. Condensate piping routing, size, and pump connections.
 - 3. Detailed power wiring diagrams.
 - 4. Detailed control wiring diagrams.
 - 5. Locations of required access through fixed construction.
 - 6. Drawings required by manufacturer.
 - 7. Architect will furnish CAD files for use in preparing shop drawings.
- D. Design Data:
- 1. Provide design calculations showing that system will achieve performance specified.
 - 2. Provide design data required by ASHRAE Std 90.1 I-P.

- E. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- F. Operating and Maintenance Data:
 - 1. Manufacturer's complete standard instructions for each unit of equipment and control panel.
 - 2. Custom-prepared system operation, troubleshooting, and maintenance instructions and recommendations.
 - 3. Identification of replaceable parts and local source of supply.
- G. Warranty: Executed warranty, made out in Owner's name.
- H. Specimen Warranty: Copy of manufacturer's warranties.
- I. Project Record Documents: Record the following:
 - 1. As-installed routing of refrigerant piping and condensate piping.
 - 2. Locations of access panels.
 - 3. Locations of control panels.
- J. Manufacturer's startup reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Company that has been manufacturing variable refrigerant flow heat pump equipment for at least 10 years.
 - 2. Company that provides system design software to installers.
- B. Installer Qualifications:
 - 1. Trained and approved by manufacturer of equipment.
 - 2. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original owner from date of installation.
- C. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- D. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
- E. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

1.8 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.
- B. The VRF units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.
- C. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original owner from date of installation. This warranty shall not include labor.

PART 2 PRODUCTS

2.1 GENERAL

- A. Simultaneous heating/cooling (heat recovery) systems shall consist of an outdoor unit, BC (Branch Circuit) Controller (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.
- B. No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit. Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.
- C. Basis of design VRF system is Trane/Mitsubishi City Multi heat pump heat recovery equipment with 2-pipe configuration. Alternate three-pipe systems with branch selectors at each runout shall be acceptable.
 - 1. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

2.2 HVAC SYSTEM DESIGN

- A. System Operation: Heating and cooling, simultaneously.
 - 1. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
 - 2. Conditioned spaces are indicated on drawings.
 - 3. Outdoor/Condenser unit locations are indicated on drawings.
 - 4. Indoor/Evaporator unit locations are indicated on drawings.
 - 5. Branch selector unit locations for 3-pipe systems are not indicated on drawings.
 - 6. Required equipment unit capacities are indicated on drawings.
 - 7. Refrigerant piping sizes for 2-pipe systems are indicated on drawings.
 - 8. Connect equipment to condensate piping provided by others; condensate piping is indicated on drawings.
- B. Controls: Provide the following control interfaces:
 - 1. For Each Indoor/Evaporator Unit: One wall-mounted wired "local" controller, with temperature sensor; locate where indicated.
 - 2. _____ wireless remote controllers for _____.
 - 3. One central remote control panel for entire system; locate in mechanical room.
 - 4. BACNet gateways sufficient to connect all units to building automation system by others; include wiring to gateways.
- C. Local Controllers: Wall-mounted, wired, containing temperature sensor.

2.3 EQUIPMENT

- A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
 - 1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
 - 2. Refrigerant: R-410A.
 - 3. Performance Certification: AHRI Certified; www.ahrinet.org.
 - 4. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
 - 5. Provide units capable of serving the zones indicated.
 - 6. Energy Efficiency: Report EER and COP based on tests conducted at "full load" in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

2.4 OUTDOOR/CONDENSING UNITS

- A. General:
 - 1. The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
 - 2. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.
 - 3. Outdoor unit shall have a sound rating no higher than 68 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
 - 4. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.
 - 5. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.
 - 6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.
 - 7. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
 - 8. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.
 - 9. The outdoor unit shall be capable of operating in heating mode down to -25F ambient temperatures or cooling mode down to 23F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost,

and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

10. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.
 11. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.
 12. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.
 13. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.
- B. Low Ambient Kit
1. The outdoor unit shall be capable of operating in cooling mode down to -10°F with manufacturer supplied low ambient kit.
 2. Low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
 3. Low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
 4. Low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
- C. Unit Cabinet:
1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
 2. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.
 3. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.
- D. Fan:
1. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.
 2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
 3. All fans shall be provided with a raised guard to prevent contact with moving parts.
- E. Outdoor Coil:
1. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil.
 2. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates.
 - a. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design.
 - b. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

3. The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction. The coil fins shall have a factory applied corrosion resistant finish. Uncoated aluminum coils/fins are not allowed.
 4. The coil shall be protected with an integral metal guard.
 5. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
 6. Unit shall have prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Panel heaters are recommended for operating environments where the ambient temperature is expected to stay below -1F for 72 hours.
 7. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.
- F. Compressor:
1. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.
 2. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.
 3. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.
 4. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.
 5. The compressor shall be equipped with an internal thermal overload.
 6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.
 7. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.
- G. Controls:
1. Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand. The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.
 2. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.

H. Electrical:

1. The outdoor unit shall be controlled by integral microprocessors.
2. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.5 BRANCH CIRCUIT CONTROLLERS

A. General:

1. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.
2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
3. This unit shall be mounted indoors, with access and service clearance provided for each controller.
4. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant Piping (specifications in addition to those for outdoor unit):

1. All refrigerant pipe connections shall be brazed.
2. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.

D. Refrigerant valves:

1. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

E. Condensate Management:

1. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

F. Electrical:

1. The BC Controller shall be controlled by integral microprocessors.
2. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.6 BRANCH SELECTOR UNITS

A. General: Provide branch selector units for use with all 3-pipe systems.

B. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves,

subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.

1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
5. Refrigerant Connections: Braze type.
6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.7 INDOOR/EVAPORATOR UNITS

A. Wall Mounted Indoor Units

1. General:
 - a. The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
2. Unit Cabinet:
 - a. All casings, regardless of model size, shall have the same white finish
 - b. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.
 - c. There shall be a separate back plate which secures the unit firmly to the wall.
3. Fan:
 - a. The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.
 - b. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
 - c. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
4. Filter:
 - a. Return air shall be filtered by means of an easily removable, washable filter.
5. Coil:
 - a. Basis of design indoor units include factory-installed LEV/EEV.
 - 1) Alternative brands which require field-installed, accessory LEV or EEV kits are permissible only with written Engineer and Architect approval for the location of kits being submitted two weeks prior to bid date.
 - 2) EEV kits mounted in cavities inside fire-rated interior walls shall be mounted inside three hour fire rated enclosures with access panels supplied by the manufacturer. Enclosure type and placement require prior approval.
 - b. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
 - c. The coils shall be pressure tested at the factory.
6. Controls:

- a. The unit shall include an IR receiver for wireless remote control flexibility.
 - b. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
 - c. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
 - d. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
 - e. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
- B. 4-Way Ceiling-Recessed Cassette with Grille For 2x2 Grid Indoor Units
- 1. General:
 - a. The indoor unit shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.
 - 2. Unit Cabinet:
 - a. The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
 - b. The cabinet panel shall have provisions for a field installed filtered outside air intake.
 - c. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
 - 3. Fan:
 - a. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
 - b. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
 - c. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of five (4) speed settings, Low, Mid, High and Auto.
 - d. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
 - e. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
 - f. Grille shall include a factory-installed "i-see" sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring size & temperature of objects within a 39' detecting diameter (based on 8.8ft mounting height) with 1,856 or more measuring points.
 - 4. Filter:
 - a. Return air shall be filtered by means of a long-life washable filter.
 - 5. Coil:
 - a. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
 - b. The coils shall be pressure tested at the factory.

- c. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.
 - 6. Controls:
 - a. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
 - b. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
 - c. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
 - d. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
 - e. A factory-installed drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur, the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.
- C. High Static Ceiling-Concealed Ducted Indoor Units
 - 1. General:
 - a. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.
 - 2. Unit Cabinet:
 - a. The cabinet shall be ceiling-concealed, ducted with a fixed rear return and a horizontal discharge supply.
 - b. The cabinet panel shall have provisions for a field installed filtered outside air intake.
 - 3. Fan:
 - a. Indoor unit shall feature adjustable external static pressure settings up to 1.00 in. WG.
 - b. The indoor unit fan shall be an assembly with one or two statically and dynamically balanced Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.
 - 4. Filter:
 - a. Return air shall be filtered by a field-supplied filter.
 - 5. Coil:
 - a. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
 - b. The coils shall be pressure tested at the factory.
 - c. Coil shall be provided with a sloped drain pan. Units without sloped drain pans which must be installed cockeyed to ensure proper drainage are not allowed.
 - 6. Controls:
 - a. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
 - b. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.

- c. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
 - d. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
- D. Auxiliary Hydronic Heat Exchanger Units
 - 1. General:
 - a. The indoor unit shall consist of a floor-standing indoor section with a modulating linear expansion device and a single brazed plate refrigerant to water heat exchanger.
 - b. The unit shall be factory assembled, wired and run tested.
 - c. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, heat exchanger, and control circuit board. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch.
 - d. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
 - 2. Unit Cabinet:
 - a. The casing shall have a galvanized sheet metal finish.
 - 3. Heat Exchanger:
 - a. The single brazed plate heat exchanger shall be capable of providing water up to 115°F and cooling water down to 50°F.
 - 4. Strainer:
 - a. The unit shall be provided with a Y-Strainer to be installed on the water inlet.
 - 5. Piping:
 - a. The tubing shall have inner grooves for high efficiency heat exchange.
 - b. All tube joints shall be brazed with phos-copper or silver alloy.
 - c. The coils shall be pressure tested at the factory.
 - 6. Controls:
 - a. The unit shall have the capability of interlocking operation with water side circulator.
 - b. The unit shall have the capability of selecting inlet or outlet water temperature as controlled variable.
 - c. The unit shall have the capability of automatically resetting control target based on outdoor air temperature.
 - d. The unit shall have the capability of manually resetting control target from a remote source signal.

2.8 REFRIGERANT PIPING

- A. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.
- B. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.
- C. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

2.9 REFRIGERANTS

- A. R410A refrigerant shall be required for systems.
- B. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for

alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.
- B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.
- C. Notify Architect if conditions for installation are unsatisfactory.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
- C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- D. Coordinate with installers of systems and equipment connecting to this system.
- E. Provide isolation valves at each connection to outdoor units, indoor units, branch circuit controllers, branch selectors, and other VRF system components connected to the refrigerant piping system.

3.3 SYSTEM STARTUP

- A. Provide manufacturer's field representative to perform system startup.
- B. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
- C. Adjust equipment for proper operation within manufacturer's published tolerances.

3.4 CLEANING

- A. Clean exposed components of dirt, finger marks, and other disfigurements.

3.5 COMMISSIONING

- A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.
- B. Refer to Division 1 for additional commissioning requirements.
- C. Perform commissioning as specified in Section 23 08 00.
- D. Replace components not functioning properly.

3.6 CLOSEOUT ACTIVITIES

- A. Refer to Division 1 for closeout submittal requirements.
- B. Refer to Division 1 for additional demonstration and training requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
 2. Conduct walking tour of project.
 3. Briefly describe function, operation, and maintenance of each component.
- E. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of one day of training.
 3. Instructor: Manufacturer's training personnel.
 4. Location: At project site.

3.7 PROTECTION

- A. Protect installed components from subsequent construction operations.
- B. Replace exposed components broken or otherwise damaged beyond repair.

3.8 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.9 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 82 00

CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electric unit heaters.

1.2 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures and Section 23 05 00 - Common Work Results for HVAC.
- B. Required submittals:
 - 1. Product data.
 - 2. Test & inspection reports:
 - a. Completed manufacturer's startup checklist & report.
 - b. Commissioning report.
 - 3. Project record documents.
 - 4. O&M data
 - 5. Warranty information:
 - a. Manufacturer's warranty.
 - 6. Training certificates.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ELECTRIC UNIT HEATERS (EUH-1)

- A. Natural convection heavy-duty electric wall fin are furnished to meet the specified wattage, voltage and size. Units installed and wired in accordance with the manufacturer's recommendations and applicable national and local codes.

- B. Electric wall fin heaters designed to be securely attached to the wall (or optional floor mounted on pedestals) per manufacturer's instructions.
- C. Heaters are wired for either right or left hand entry where there are no controls, otherwise entry will be in the junction box containing controls.
- D. Heaters with bottom air intake and top air exit and front air intake (inlet grille) and top air exit (both wall and pedestal styles) must be mounted a minimum of 3" (76 mm) off the finished floor.
- E. Heaters with front air intake (inlet grille) and top air exit can be wall mounted at the finished floor level and are approved for zero clearance at the bottom.
- F. Units are of modern square design, constructed of specified materials and contain totally enclosed junction boxes at both ends, aluminum fin tube element(s), thermal overload and a 1/2" (13 mm) EMT prewired 40 ampere wireway. Heater lengths furnished in 2 foot (0.6 M) through 10 foot (3.0 M) in 1 foot (0.3 M) increments. 1/2" (13 mm) and 3/4" (19 mm) knockouts are provided on the side and rear of the heaters junction box to allow end to end wiring for wall mounted units and in the bottom of the junction box only for floor mounted heaters.
- G. Enclosure front panel are of one piece construction suitable for architectural, commercial and industrial use, with 1/4" (6.4 mm) pencil-proof top air discharge and or front air intake louvers.
- H. Louvers discharge heated air at a 15 degree angle for cleaner operation. The one-piece front panel is extruded for maximum strength and is available in lengths to 15 feet (4.6 M). Front panel snap fit to the back panel without fasteners for two-piece construction.
- I. Back panel is pre-punched for easy installation and is suitable for mullion to mullion installation for wall mounted heaters only.

2.2 ELECTRIC UNIT HEATERS (EUH-2)

- A. General
 - 1. The heating equipment shall include an electric automatic fan forced air heater suitable for small area heating. The heater shall be designed for wall mounting, recess or surface. Heaters shall be UL listed or equivalent (ETL).
- B. Backbox
 - 1. The backbox shall be designed for duty as a recessed rough-in box in either masonry or frame installations and is also used with the surface mounting frame in surface mounting installations. The backbox shall be heavy gauge galvanized steel and shall contain knockouts through which power leads are brought.
- C. Inner Frame Assembly
 - 1. The heater assembly which fits into the backbox shall consist of a heavy gauge steel fan panel upon which is mounted all of the operational parts of the heater. The inner frame assembly shall be completely pre-wired.
- D. Heating Element
 - 1. The heating element shall be of the non-glowing design consisting of an 80/20 nickel-chromium resistance wire enclosed in a steel sheath to which plate fins are copper brazed. It shall be warranted for 5 years. The element shall cover the entire air discharge area to ensure uniform heating of all discharge air.
- E. Power On/Off Switch
 - 1. A double-pole single throw ON/OFF switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front cover.
- F. Motor And Controls
 - 1. The fan motor shall be impedance protected, permanently lubricated and with totally enclosed rotor. Fan control shall be of the bi-metallic, snapaction type and shall activate fan after heating element reaches operating temperature, and continue to operate the fan after the thermostat is satisfied and until all heated air has been discharged. The thermostat shall be single pole type on all models. Manual-reset thermal cutout shall be

bi-metallic, snapaction type designed to shut off heat in the event of overheating. The fan shall be four-bladed aluminum.

- G. Surface Mounting Frame
 - 1. The surface mounting frame shall be of heavy gauge steel designed to mount around the backbox for a finished surface installation. Slot knock outs shall be provided for power supply conduit.
- H. Front Cover
 - 1. The louvered front cover shall be of heavy gauge steel with a polyester powder coat finish. A plug button will be provided to replace the thermostat knob and render the unit tamper-resistant.
- I. Finish
 - 1. All sheet metal parts, except the galvanized steel backbox, shall be phosphatized, then completely painted by a powder paint process.

2.3 ELECTRIC UNIT HEATERS (EUH-3)

- A. The heater shall be designed for wall recess or surface mounting.
- B. Heater Assembly
 - 1. The heater assembly which fits into the back box shall consist of an 0.120" thick, powder coated aluminum die cast part fan panel / panel grille which are mounted all of the operational parts of the heater. The front grille shall be of the louvered type finished in polyester powder coating which resists fading and abrasion.
- C. Heating Elements
 - 1. The heating elements shall be warranted for five years and shall be of non-glowing design consisting of 80-20 Ni/Cr resistance wire enclosed in a steel sheath to which steel plate fins are brazed. The heating element shall cover the entire air discharge area to ensure uniform heating of all discharge air.
- D. Thermal Limit
 - 1. The heater shall be equipped with a manual-reset safety limit control that will automatically shut off heater in event of overheating due to any cause. The safety cutouts shall directly interrupt power to the elements. A red warning light will illuminate (visible at top of heater grille) to alert that this control has been activated.
- E. Fan and Motor Assembly
 - 1. The motor and fan assembly shall be direct drive and mounted on rigid heavy gauge brackets for quiet operation. The fan shall be five-bladed aluminum. The fan motor shall be totally enclosed.
- F. Fan Delay Control
 - 1. Fan control shall delay fan startup of the fan motor until the heating elements have warmed up. It shall maintain motor operation after heating elements have been de-energized to dissipate residual heat build-up.
- G. Temperature Control
 - 1. The unit is designed to be controlled electronically with a built-in electronic digital LCD touch screen display mounted on the grille and control board mounted on the fan panel. This control will maintain room temperatures within 1-½ degrees of set point. The output of heat is proportionally controlled as to how much heat is needed to satisfy the set point. Heater automatically adjusts wattage output for optimum comfort. Heater settings can be locked out for security purposes.
- H. Disconnect Switch
 - 1. This ON/OFF switch shall be mounted on the fan deck to disconnect single point connection to power supply for the internal electrical components, including the heating element. It will be completely concealed behind the front grille panel.

I. Building Management Connection

1. The unit shall include a unique built-in Building Management System (BMS) connection. This allows the building management system to connect directly to the heater using a dry contact switch (no voltage) to control the heater. A BMS icon is illuminated and all other icons are turned OFF and all buttons are disabled.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are suitable for installation.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
- C. Do not damage equipment or finishes.
- D. Unit Heaters:
 1. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Provide manufacturer's field representative to test, inspect, and instruct.

3.4 CLEANING

- A. After construction and painting is completed, clean exposed surfaces of units.
- B. Vacuum clean coils and inside of units.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
- D. Install new filters.

3.5 PROTECTION

- A. Provide finished cabinet units with protective covers during the balance of construction.

3.6 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.7 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 82 16
AIR COILS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electric coils.

1.2 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- C. Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.
- B. Protect coils from entry of dirt and debris with pipe caps or plugs.

PART 2 PRODUCTS

2.1 ELECTRIC COILS

- A. Assembly: UL listed and labelled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
- B. Coil: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

- C. Casing: Die formed channel frame of 16 gauge, 0.0598 inch galvanized steel with 3/8 inch mounting holes on 3 inch centers. Provide tube supports for coils longer than 36 inches.
- D. Controls: Automatic reset thermal cut-out, built-in magnetic contactors, control circuit transformer and fuse, manual reset thermal cut-out, air flow proving device, fused disconnect, load fuses.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install in ducts and casings in accordance with SMACNA (DCS).
 - 1. Provide airtight seal between coil and duct or casing.
- C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- D. Electric Duct Coils: Wire in accordance with NFPA 70.

3.2 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 - 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 - 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 23 83 00

RADIANT HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electric infrared radiant heaters.

1.2 REFERENCE STANDARDS

- A. ASHRAE Std 138 - Method of Testing for Rated Ceiling Panels for Sensible Heating and Cooling; 2016.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 2021 - Fixed and Location Dedicated Electric Room Heaters; Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Refer to Division 1 for submittal procedures.
- B. Product Data: Provide data for electric cabling, electric infrared radiant heaters, and electric radiant heaters.
- C. Shop Drawings: Indicate electric cabling and electric radiant heater layout, electrical terminations, thermostats, controls, and branch circuit connections.
- D. Manufacturer's Installation Instructions: Indicate installation instructions and recommendations.
- E. Field Quality Control Submittals: Indicate test reports and inspection reports.
- F. Project Record Documents: Record actual locations of electric cabling, infrared heaters, thermostats, and electric radiant heaters.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, installation instructions, maintenance and repair data, and parts listings.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Data:
 - 1. Include repair methods and parts list of components.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.5 WARRANTY

- A. Refer to Division 1 for additional warranty requirements.
- B. Provide 5 year manufacturer's warranty for electric radiant heaters.

PART 2 PRODUCTS

2.1 ELECTRIC INFRARED RADIANT HEATERS

- A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- B. Factory assembled including heating element, reflector, heater housing, mounting brackets, element holders, wire guards, and high temperature internal wiring for non-residential, indoor use only.
- C. Heating Element:
 - 1. Minimum 3/8 inch diameter quartz tube with coiled resistor wire.
 - 2. Element operating temperature range: 1200 to 1800 degrees F.
- D. Heater Housing:
 - 1. Factory fabricated from aluminum clad steel, stainless steel, aluminum, or low carbon steel for indoor use as indicated.
 - 2. Provide with baked enamel finish over corrosion-resistant primer.
 - 3. Furnish chrome plated or stainless steel wire guard designed to protect heating elements from damage.
 - 4. Supply mounting chain(s) to position heater in any horizontal angle.
- E. Reflector: Polished aluminum or stainless steel.
- F. Wiring:
 - 1. Fully enclosed internal wiring.
 - 2. Provide minimum 6 inch slack fixture (heater) wire for connection to branch circuit wiring.
- G. Accessories:
 - 1. Relay panel for control of radiant heaters by building DDC controls.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Electric Infrared Radiant Heaters: Verify and maintain minimum distances from combustibles. Verify heater installation is not in a hazardous location.

3.2 PREPARATION

- A. Clean all surfaces prior to installation.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. Electric Infrared Radiant Heaters:

1. Install in accordance with manufacturer's instructions.
2. Comply with applicable codes.
3. Maintain minimum distances from all combustibles in accordance with manufacturer's instructions and applicable codes.
4. Suspend heater with chains, so that quartz tubes are horizontal, preventing sagging and premature burnout.

3.4 FIELD QUALITY CONTROL

- A. Provide manufacturer's field representative to test, inspect, instruct, and observe.
- B. Electric Infrared Radiant Heaters:
 1. Perform the following field tests and inspections and prepare test reports:
 - a. Operate electric heating elements to verify proper operation and electrical connections.
 - b. Test and adjust controls and safeties.
 2. Remove and replace malfunctioning units and retest as specified above.

3.5 CLOSEOUT ACTIVITIES

- A. Demonstrate Operation of Controls for the following Equipment:
 1. Electric Infrared Heaters.

3.6 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

3.7 LEED REQUIREMENTS

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Energy & Atmosphere – Fundamental Building Commissioning and Verification: Comply with provisions of Section 01 91 00.
 2. Energy & Atmosphere – Enhanced Commissioning: Comply with provisions of Section 01 91 00.
 3. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
- B. Verify products have been stored, and will be installed, in accordance with project's Construction Indoor Air Quality Management Plan specified in Section 01 81 16 Construction Indoor Air Quality Management.

3.8 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

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. Reference Section 01 23 00 Base Bid and Deductive Bid Items for bid items.
- D. General Requirements: Conform to Contract Documents. This section is supplemental and in addition to requirements of Division 01.
- E. Reference Section 01 81 13.13 LEED Requirements
- F. 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.
- G. 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.
- H. 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. IEEE - Institute of Electrical and Electronic Engineers
 - 2. IES - Illuminating Engineering Society
 - 3. NEMA - National Electrical Manufacturers Association
 - 4. NEC - National Electrical Code
 - 5. IBC - International Building Code
 - 6. IFC - International Fire Code
 - 7. ADA - Americans with Disabilities Act
 - 8. NFPA - National Fire Protection Association

1.3 CODES

- A. Codes for installation of electrical work shall be National 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. 110-26 of National Electric 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.

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 (WAC)
 - 12. WAC - Washington Administrative Code
 - 13. NEC - National 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.

B. LEED Requirements

1. General: This is a LEED affected Specification Section. Comply with all applicable LEED requirements as specified in this Project Manual, including the following:
 - a. 01 81 13.13 – LEED Requirements
2. Required LEED Credits: As specified in Division 1 – 01 81 13.13 – LEED Requirements and as indicated in “Apn-018113-LEED Credit Matrix” document in the Appendix applicable to this Specification Section.
3. Submittals:
 - a. Product Data: Submit product data highlighting LEED specific data applicable to the LEED credits required for this Specification Section. Clearly distinguish or fully separate LEED data from other general product data required for each Specification Section.
 - b. LEED Product Information Form: Submit the completed LEED Product Information Form in accordance with the template provided in the Appendix document “Apn-018113-LEED Product Information Form”.

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 Engineer are approximate only. Obtain exact rough-in locations from the following sources:
 - a. From Shop Drawings for Contractor provided equipment.
 - b. From Consultant for Engineer 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. Also Refer to Division 01.
- B. 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.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. 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 08 31 13 "Access Doors and Frames."
- E. Coordinate sleeve selection and application with selection and application of firestopping.
- F. 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 no cost to engineer.
- G. Electrical drawings and specifications shall be compared with drawings and specifications of other trades and any discrepancies between them reported to the Consultant prior to installation of work.
- H. 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 in accordance with Division 01.

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 with Puget Sound Energy
 - 2. Secondary feeder for power service to building
 - 3. Lighting System and fixtures
 - 4. Fire Alarm System
 - 5. Branch wiring, power, lighting, and equipment
 - 6. Generator
 - 7. Equipment connections
 - 8. Data and Telephone Cabling System
 - 9. TV Cabling System
 - 10. Site electrical work
 - 11. Low Voltage Lighting Control
 - 12. Access control system wiring
 - 13. Intrusion Detection System wiring
 - 14. CCTV System wiring
 - 15. Electrical demolition

1.17 SUBMITTALS

- A. General:
 - 1. Submittals shall be in accordance with requirements of Division 01.
 - 2. Forward all submittals to the Consultant, 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. Operation and Maintenance:

- a. Subsequent to final completion, and testing operations, instruct Consultant in operation, adjustment, and maintenance of electrical plant.
- b. Before Engineer'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 Consultant 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. Switchboard and panelboards
5. Generator
6. Data and voice cabling system
7. TV cabling system
8. Instruction Detection System
9. CCTV system wiring
10. Access Control System

1.18 ELECTRICAL EQUIPMENT MAINTENANCE MANUALS

- A. Also Refer to Division 01.
- B. The Electrical Contractor shall prepare maintenance manuals for the servicing of all equipment installed as a part of the construction contract.
- C. 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.
- D. Bind in 3-ring binder with label clearly indicating project.

1.19 JOB RECORD INFORMATION

- A. Refer to Division 01.
- B. Drawings shall include dimensions on all underground conduit.

1.20 NAMEPLATES AND TAGS

- A. The following items shall be equipped with tags or nameplates with etched letters:
 - 1. All motors, motor starters, pushbutton stations, control panels and time switches. 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.

1.21 Low Voltage

- A. 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.
- B. Tags for 120/208 volts shall be laminated phenolic plastic with white engraved letters on black 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.

1.22 FINAL SUBMITTALS

- A. Refer to Division 01
- B. After completion of all electrical work and prior to final inspection, submit the following:
 - 1. One copy of the electrical equipment maintenance manual (see 1.15) to be sent direct to Consultant for review, containing the following:
 - a. Letter of transmittal, addressed to Consultant, 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 Consultant's notations.
 - c. Catalog cuts of all lighting fixtures, lamps, 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.
2. Refer to Division 01 for Operations and Maintenance Manuals.

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 no cost to engineer.
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. Firestopping and Smokestopping:

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. 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.

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. Follow manufacturer's directions in all cases where manufacturers of articles used furnish directions covering points not shown or specified.
- B. 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.
- C. 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.
- D. Provide hangers, supports, anchors and chases as required for installation of Electrical Work.
- E. Excavating and Backfilling: In accordance with requirements of Division 31 and 32. Provide all necessary shoring, sheeting, and pumping as part of Work of this Division.
- F. Concrete: In accordance with requirements of Division 03.
- G. 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, Consultant 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 Section 07 92 00 "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.
- 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.

END OF SECTION 260500

SECTION 260519 – LOW VOLTAGE CABLE AND TERMINATIONS

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.
- D. Refer to Division 01 for additional requirements.

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. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.

4. Senator Wire & Cable Company.
 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70. Minimum size - No. 12 AWG. Stranded.
- C. Aluminum Conductors: Allowed as substitute for copper for sizes #2 and larger. Burndy hy-lug connectors shall be used for aluminum wire terminations. Wire size shall be rated for ampacity equal or greater than ampacity of scheduled copper conductors. Increase conduit sizes if necessary for aluminum conductors.
- 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: Proved 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 underground. All circuits shall be installed in raceway when installed in walls and non-accessible spaces.

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 V.-Black, 208 V - Red, White – Neutral, Green – Ground, Isolated Ground – Green with Yellow stripe, Purple “Travellers” on 3 and 4 way switching. 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 26 05 29 "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section 26 05 53 "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.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum 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 FOR ELECTRICAL SYSTEMS

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. Operation and Maintenance Data: For grounding to 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. 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 to supervise on-site testing specified in Part 3.
- 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 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 by 10 feet in diameter or as required by code authority.

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. 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.
- E. 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. Flexible raceway runs.
 - 6. 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.
 - 7. 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 Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. 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.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 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 26 05 43 "Underground Raceways," 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. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than 24 inches from building foundation.
- I. 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.
- J. Consult with code authority and comply with all code authority requirements.

3.5 POOL GROUNDING

- A. Refer to electrical plans for grounding in pool area.
- B. Provide all grounding for pool area in compliance with NEC Article 680.
- C. Coordinate with pool installer.

3.6 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.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Consultant promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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 Consultant, 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.

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.
- D. See Division 01 for additional requirements.

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.

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.
 - h. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. 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.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "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 slotted support 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 05 50 00 "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 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

SSECTION 260533 -RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
 - 1. ENT: Electrical nonmetallic tubing.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. FMC: Flexible metal conduit.
 - 4. IMC: Intermediate metal conduit.
 - 5. LFMC: Liquidtight flexible metal conduit.
 - 6. LFNC: Liquidtight flexible nonmetallic conduit.
 - 7. NBR: Acrylonitrile-butadiene rubber.
 - 8. RNC: Rigid nonmetallic conduit.
 - 9. RGS: Rigid galvanized steel
 - 10. PVC: Polyvinyl Chloride

1.3 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. 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 consultant and testing agency.
- E. Source quality-control test reports.
- F. See Division 01 for additional requirements.

1.4 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. Alflec 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 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: Aluminum or steel. UL listed.

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 except for fiber optic cable innerduct in raceway.
- C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated as PVC 80.
- D. LFNC: Not permitted.
- E. Fittings for ENT and 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 boxes minimum 2 1/8-inch deep.
- 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: Steel City #AFM6 with GAB6 cast box with devices per drawings.
- F. Nonmetallic Floor Boxes: Not permitted.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- I. 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.

J. 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.

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 consultant 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. 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: RNC, Type EPC-40-PVC, direct buried with plastic coated RGS bends and sweeps.
 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.
- B. Comply with the following indoor applications, unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT or MC cable. MC cable allowed for branch circuits. Homeruns shall be EMT.
 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.
- C. 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.
- D. Communications and Electronic Safety and Security: Shall be EMT overhead. Underground is not permitted except for connections between MDF and IDF's.
- E. 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 26 05 29 "Hangers and Supports for Electrical Systems"
- 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 semi-recessed 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 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.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of 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 07 92 00 - "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.
- 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.

3.5 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.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.7 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.

END OF SECTION 260533

SECTION 260534 – RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for raceways, fittings, and boxes specific to communications circuits (cabling) for television, voice, and data which are additional to, or different from, that of Division 26.

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)
 - 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 26 except where specifically noted below.

2.2 MATERIALS

- A. Conduit: Minimum conduit size shall be 3/4 inch. Provide EMT, IMC or RGS conduit except as noted below:
- Underslab, and in floor: Provide PVC Schedule 40 with RGS bends or rigid galvanized steel with external PVC coating. Protect male threads of conduit with PVC coating using an application of an electrically conductive two-part urethane coating.
 - Rigid Aluminum, ENT, and Flex conduit are not acceptable.
- B. Device boxes: Provide device boxes as follows:
- For flush outlets to be used for wall mounted telephones:
 - Device boxes shall be single gang 2.125" depth with single gang extension rings covers ((i.e. device covers, mud rings).
 - Surface mounted outlets – Not allowed.
 - For all other outlets:
 - Device boxes shall be double gang deep depth with single 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 3/4" 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 paint. Refer to Division 9.
- D. Pull Boxes: Provide pull boxes (junction boxes) as shown on the Drawings and as required. 90 degree condulets (LB's) are not acceptable.
- Pull boxes shall be sized as follows:

Conduit	Maximum For Each			
	Trade Size	Box Width	Box Length	Additional Conduit
1"		4"	16"	3"
1-1/4"		6"	20"	3"
1-1/2"		8"	27"	4"
2"		8"	36"	4"
- 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.
- F. Grounding Conductor: Provide #6 AWG insulated solid copper conductor (green) to bond all metallic raceway to the nearest grounding bus bar (as provided under Division 26).
- 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.

PART 3 - EXECUTION

3.1 GENERAL

- A. All work shall comply with Division 26.
- 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 Article 1.03, — 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. 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 Article 1.03 — References, above.
- F. 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.
- G. 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.
 - 1) 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" 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.
 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 International Building Code, International Fire Code, WAC, National Electrical Code, Seattle Electric 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 bar (as provided under Division 26. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic raceway.

END OF SECTION 260534

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway.
 - 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.
 - 8. Panel Directories
 - 9. Identification for receptacles

1.2 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.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.4 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 Circuits: White letters on a black field.
 - 2. Fire Alarm: White on red.
 - 3. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: 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, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- 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 white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 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:

1. 120/208 Volt Normal: Black
2. 120 Volt Emergency: orange
3. Fire Alarm: Red
4. Intercom/Clock: Gray
5. Data/Phone: Blue
6. Television: White
7. 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.

D. Panel directories shall indicate each circuit by load and Field Room number (Drawing room numbers are not acceptable. Spares and spaces shall be indicated in erasable ink or pencil.)

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. Security System: Blue and yellow.
 3. Mechanical and Electrical Supervisory System: Green and blue.
 4. Telecommunication System: Green and yellow.
 5. 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:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 2. 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. Emergency system boxes and enclosures.
- e. Disconnect switches.
- f. Enclosed circuit breakers.
- g. Motor starters.
- h. Push-button stations.
- i. Power transfer equipment.
- j. Contactors.
- k. Remote-controlled switches, dimmer modules, and control devices.
- l. Power-generating units.
- m. Intercommunication and call system master and staff stations.
- n. Fire-alarm control panel and annunciators.
- o. Junction boxes: System, voltage and circuit with black pen.
- p. Receptacles: Panel and circuit number.
- q. Data outlets: Per owner standards. Coordinate with owner.

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. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. 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.
- I. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 260553

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. System coordination study for normal systems.
2. Short circuit study for normal and emergency systems.
3. Protective device calibration and setting to achieve coordination.
4. Arc fault study per NEC 70E or entire system. 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. The system coordination engineer must include a statement in the front of the study stating that Selective Coordination has been provided to meet NEC 700.27. The report shall have the coordination engineer's stamp on the cover page.
6. Contractor shall provide all changes including transformers, fuses, wire size and conduit size changes required by the coordination engineer.

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.
- F. Study shall be stamped by the coordination study engineer with a Professional Engineer's stamp from the State of Washington
- G. Report shall not be submitted until complete compliance with NEC 700.27 is complete. Contractor shall provide all devices as directed in the coordination study.

- H. Coordination Study Engineer report and stamp states that the coordination engineer is stating that the system complies with NEC 700.27 and 701.18.

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, Square D, GE.

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

SECTION - 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this section is to specify the Contractor's responsibilities relative to Division 26 and participation in the commissioning process. See Division 1, Section 019100, "Commissioning," for Contractor-related commissioning requirements.
 - 1. Organization of the commissioning program is primarily the responsibility of the Commissioning Authority. Execution of the program is primarily the responsibility of the Contractor with support from the Division 26 for:
 - a. Testing and start-up of the electrical equipment.
 - b. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operational and ready for functional testing.
 - c. Providing qualified personnel to assist the Commissioning Authority with functional testing to verify equipment/system performance.
 - d. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
 - e. Providing training for the systems specified in Division 26 with coordination of Owner by the Commissioning Authority.
- B. Division 26 shall cooperate with the Commissioning Authority in the following manner:
 - 1. Allow sufficient time before final completion dates so that electrical testing, lighting control checkout, and functional testing can be accomplished.
 - 2. Provide labor and material to make corrections when required without undue delay.
 - 3. Put all electrical systems and equipment into full operation and continue the operation of the same during each working day of commissioning.
- C. Related Sections
 - 1. Section 019100 - Commissioning
 - 2. Division 22 - Plumbing
 - 3. Division 23 - Mechanical
 - 4. Division 26 - Electrical

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Standard certified test equipment for commissioning will be provided by the Commissioning Authority.

- B. Proprietary test equipment required by the manufacturer shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

PART 3 - EXECUTION

3.1 WORK PRIOR TO COMMISSIONING

- A. Specific pre-commissioning responsibilities of Division 26 are as follows:
 - 1. Normal start-up services required to bring each system into a fully operational state.
 - 2. Complete pre-functional test checklists for all equipment and systems to be commissioned
 - 3. Portions of mechanical equipment start-up requiring electrical connections and metering.
 - 4. Factory start-up services for key equipment and systems specified in Division 26. The Division 26 Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.
 - 5. Demonstrate system readings as requested by the Commissioning Authority and adjust units to achieve specified operation.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Division 26 Contractor shall provide skilled technicians to start-up and debug all systems within the Division 26 work (particularly with lighting equipment). These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed upon schedules, and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.
- C. Provide skilled technicians to manipulate the following equipment and systems to be commissioned for functional testing:
 - 1. Power for mechanical systems
 - 2. Lighting control systems
 - 3. Day lighting control system

3.3 WORK TO RESOLVE DEFICIENCIES

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet Acceptable Performance. Correction of work will be completed under the direction of the Owner/Architect, with input from the Contractor, Equipment Supplier, and Commissioning Authority. Whereas all members will have input and the opportunity

to discuss, debate, and work out problems, the Architect/Engineer-of-Record will have final jurisdiction on the necessary work to be done to achieve performance and/or design intent.

3.4 ELECTRICAL SYSTEM TESTING

- A. Electrical system testing as required in other sections of this specification shall be coordinated with the Commissioning Authority. The Commissioning Authority may witness testing performed by the Division 26 Contractor.
- B. All testing documentation related to Division 26 equipment and systems, as specified in other sections of this specification, will be provided to the Commissioning Authority for use and review.

3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required demonstrating performance.
- B. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum, and at peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

3.6 TRAINING

- A. The Division 26 Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each electrical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.

END OF SECTION 26 08 00

SECTION 260923 – LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital Occupancy and Daylighting Sensor Control
2. Analog Occupancy Sensor Control
3. Networked Digital Low Voltage Control Panels
4. Auxiliary contacts for connection to DDC
5. BACnet connection to DDC. Send complete system status to DDC

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) (www.ulc.ca)
- 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 Low Voltage Control Panels (RELAY PANELS-LVR)– Native BACnet communicating over MSTP protocol presenting BACnet objects for all loads and groups. All connected devices including sensors and switches shall present as BACnet objects. Available in 8, 24 or 48 relay configurations with 24VDC available to support digital switches and sensors. Panel operates in conjunction with the other devices specified herein, both local and networked. Support on board clock and/or network clock functionally, while supporting free topology over a CAT5e network. Setup may be configured on board, via a handheld configuration tool, Software or via a BACnet GUI.
 3. 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. Provide auxiliary contact for connection to DDC
 - 4.
 5. 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.
 6. 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.
 7. 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.
 8. 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.
 9. 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.
 10. 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.
 11. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
 12. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS).
 13. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting. When communication between the BAS system is specified, the information shall be provided to the System Integrator in the form of object tables including Device Instance, Device Alias and Device Function for the required points.

14. Analog Occupancy Sensors and power packs – Where shown on drawings ceiling or wall corner type Dual Technology type occupancy sensors shall be installed. They shall be furnished complete with power packs and switching functions that allow for manual on operation. Momentary contact decora style switch shall be paired to sensor and power pack providing this operation.
15. 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.
16. 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 luminaires within daylighting zones as defined in the Seattle 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 – 1
 - b. Dimming Controllers – 1
 - 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 equal by Douglas, Nlight

B. Substitutions:

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.2 STAND ALONE CONTROL DEVICES

- A. General Ceiling Mount: Dual-technology Wattstopper #DT-300 with BZ-1 relay pack and additional slave pack for connection to DDC system. Wire per manufacturer
- B. General Wall Mount: Wattstopper #DT-200 with BZ-1 relay pack and additional slave pack for connection to DDC system. Wire per manufacturer
- C. Hallway and Corridor Sensors: Dual-technology Wattstopper WT with BZ-1 relay pack and additional slave pack for connection to DDC system. Wire per manufacturer
- D. Restrooms: Wattstopper UT with relay pack and additional slave pack for connection to DDC system. Wire per manufacturer.
- E. Photocell: Wattstopper LS-102 Analog with BZ-1 power pack

2.3 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.

2.4 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. Auxiliary contact for connection to DDC system
- F. WattStopper product numbers: LMDX, LMDC

2.5 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. Auxiliary contact for connection to DDC system
- F. WattStopper product numbers: LMDW

2.6 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.

2.7 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.

2.8 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, LPMC-212, LPMC-213, LMPL-201.

2.9 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 and 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 panel's 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 Manager 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.

2.10 DIGITAL PHOTSENSORS (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.

2.11 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

2.12 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

2.13 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 day 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

2.14 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.

2.15 EMERGENCY LIGHTING

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
 - 1. 120/277 volts, 50/60 Hz., 20 amp ballast rating
 - 2. Push to test button.
 - 3. Auxiliary contact for remote test or fire alarm system interface.
- B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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.

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.

END OF SECTION 260923

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 division 26 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 REFERENCES

- A. The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.
 - 1. NEMA PB 1 – Panelboards
 - 2. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 - 3. NEMA AB 1 - Molded Case Circuit Breakers
 - 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 - 5. UL 50 - Enclosures for Electrical Equipment
 - 6. UL 67 – Panelboards
 - 7. UL 98 - Enclosed and Dead-front Switches
 - 8. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
 - 9. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
 - 10. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers
 - 11. Federal Specification W-P-115C - Type I Class 1
 - 12. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.
 - 13. NFPA 70 - National Electrical Code (NEC)
 - 14. 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 one (1) year to start at substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Shall be Square D Company, General Electric, Eaton 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.

2.2 208/120 VOLT PANELBOARDS

- A. NQOD

- 1. Interior

- a. Shall be type NQOD panelboard rated for 208 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum.
 - b. Minimum short circuit current rating: as shown on drawings but minimum 10,000 in rms symmetrical amperes at 208 Vac.
 - c. 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. 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.

- 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. An additional copper isolated/insulated ground bar shall also be provided mounted on insulators.
 - f. 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.
 - 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 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.
2. 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.
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 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.
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 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.
5. Provide surge protector at all 208Y/120V panelboards where indicated on panel schedules. Provide 30/3 breaker for surge protector with maximum 8" lead length.

2.3 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 above 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. 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.
 - a. 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.
 - b. 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 galvanized 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.
- B. Housekeeping Pad: When floor mounted provide 3-inch housekeeping pad minimum 3-inches beyond footprint.

2.4 SURGE PROTECTORS

- A. Surge Suppressor shall be rated 120/208V-3Ø operation and have the following features:
1. UL 1449 2nd Edition and UL 1283 Listed
 2. Ten Year Warranty to start at substantial completion
 3. Active Tracking Network
 4. 4 mode Protection - L-N, L-G, N-G, L-L
 5. 120 KA/Ø peak surge
 6. 2250 Joule Energy Dissipation
 7. LED Lights/Ø
 8. Response time less than 1 nanosecond
 9. Mount within 8" of panel bus and breaker
 10. Provide circuit breaker in Panel whether scheduled or not.
- B. Manufacturers: Innovative Technology PTE-080.

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

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. Wall-box motion sensors.
 - 4. Switches and wall-box dimmers.
 - 5. 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.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

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. See Division 01 for additional requirements.
- F. See Division 01 for additional requirements.

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 Engineer-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

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 white 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).

2.3 GFCI RECEPTACLES

- A. All exterior receptacles, receptacles within 10 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: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 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).
 - 2. Emergency Shutdown Switches: Mushroom style switch. Red color. Provide label indicating the equipment which the switch shuts down.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices. Stainless steel.
 - 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."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum while in use with lockable cover.
 - 1. Hubbell #WP26

2.6 MULTIOUTLET ASSEMBLIES (WIREMOLD, SURFACE METAL RACEWAY)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiremold Company (The)
 - 2. B-LINE

- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Include divider, entrance fittings, corners, etc. for complete system.
- C. Raceway Material: Metal, with ivory finish.
- D. Provide duplex receptacles as shown on drawings and communications outlets as shown on drawings.

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. Pigtail 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.

J. Install fans to sloped and flat ceilings as shown on architectural plans. Follow all manufacturer's instructions. Mount fan level and true. Adjust blades so that air movement does not interfere with cable hung light fixtures.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. 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 – DISCONNECTS AND SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 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."

1.4 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.

1.5 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.

1.6 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.

1.7 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. Fused Disconnect Switches - 3
 - 2. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 3. 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 conductors only.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors only.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors only.
 - 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 conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum 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. Square D or GE (No Substitute).
- 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).

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.

2.5 SPARE FUSE CABINET

- A. Provide spare fuse cabinet in each main electric room

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 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.

1.2 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 01. 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 01 78 23 "Operation and Maintenance," 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.

1.3 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.

1.4 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.

1.5 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 07 72 00 "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.

1.6 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.
- 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. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

4. Hand off auto switch.
5. Red running and green stop pilot lights.
6. Control transformer.

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.
2. Magnetic controller per above.

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

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Elapsed Time Meters: Heavy duty with digital readout in hours.
- F. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
- G. 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 26 05 29 "Hangers and Supports for Electrical Systems."
- B. Enclosed Controller Fuses: Install fuses in each fusible switch.

3.4 IDENTIFICATION

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section 26 05 53 "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.

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.

END OF SECTION 262913

SECTION 263100 – SOLAR PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Design and provide a complete and functional photovoltaic system as specified and intent shown on the drawings. The system shall include photovoltaic cells, inverter(s), disconnects, combiner box, grid tie, metering, Puget Sound Energy coordination, and all wire and conduit and all other equipment and installation necessary for a complete and fully functional solar photovoltaic system.
- B. A sample system layout is shown on the drawings as to locations and general scope of work. The system, however, is completely designed by the contractor and contract shall include all design, layout, equipment mounting to provide a simple photovoltaic system of capacity shown below. Contract includes providing equipment and all installation, wiring, and connection to the building power system to provide a complete photovoltaic system. Contract includes an internet based metering system and installing software on monitor by the owner to provide a solar display.
- C. The contract includes the following solar options
 - 1. Base Bid: Building shall be solar ready per plans
 - 2. Alternate Bid: 30KW Solar Photovoltaic System
- D. The system shall consist of an array of photovoltaic modules with aluminum frames designed for grouping on racks, terminal and combiner box(es), quick-connect electrical connectors, DC wiring, DC disconnect, grid-connected inverter(s), AC disconnect, and a data acquisition and monitoring system (DAS) and isolation transformer, as specified in final project specifications. The inverter shall be wired to the building's electrical system.
- E. The actual orientation and tilt of the array shall be optimized based upon computer studies for the specific project location and its associated weather data and sun patterns. Provide design analysis and installation recommendations for optimum output and energy savings. The array will be installed on a flat roof with a ballasted roof support system.
- F. System to be installed on flat roof (0.25:12) with 60 mil fabric-reinforced TPO sheet roofing. System mounting shall not penetrate roof or cause any additional roof work.

1.2 WORK INCLUDED

- A. Provide engineering, labor, materials, and accessories required to furnish, install, start up, and commission complete operating solar photovoltaic systems. Labor, materials, or accessories not specifically called for in the Contract Documents, but required to provide a complete operating system shall be provided without additional cost to the Owner. All work shall be per NEC 690
- B. Determine, coordinate, and incorporate the design and construction requirements of the Architect, General Contractor, and local Power service provider.
- C. Submit to City of Fircrest Electrical to obtain plan review approval.

1.3 APPLICABLE STANDARDS

- A. Standards: The photovoltaic installation shall be designed and manufactured in compliance with the following standards and codes:
 - 1. NEC 690
 - 2. UL 1741
 - 3. IEEE 929
 - 4. Local Codes

1.4 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations and requirements of the utility companies serving the project and the Owner's insurance underwriter.
- B. Equipment supplier shall have local representation and shall have been actively engaged in installation and service of solar photovoltaic systems and inverters for a period of not less than 5 years.
- C. All equipment and installations shall meet or exceed minimum requirements of NEC, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA, UL and the Fire Marshal.
- D. Equipment shall be certified for use in the State of the project and shall meet or exceed the requirements of the State energy code.
- E. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

1.5 SUBMITTALS

- A. Submittal:
 - 1. Written technical description of the proposed systems broken down in to the following categories:
 - a. PV Panels
 - b. DC combiner boxes
 - c. DC/AC inverter
 - d. Inverter(s)
 - e. Disconnect
 - f. Metering
 - g. One line
 - h. Electrical connections
 - i. Racking
 - j. Grounding system
 - k. All other associated equipment and cabling
- B. Design Studies: Submit a study, which evaluates and determines the best orientation and slope of the solar panel arrays. The study shall examine and evaluate the associated energy production (kWh) for mounting on the roof deck and for slope at peak operation. Study shall include average bi-annual (Summer and Winter) energy production and energy cost savings for panels set at 10 degrees and for 5 degrees above and 5 degrees below and orientation to illustrate that the best orientation has been found. The Study shall make final recommendations for the best orientation that will net the highest utility cost savings. Study shall take into consideration the adjacent obstructions and typical local weather conditions

such as typical occurrences of fog or high clouds. In the condition that all panel arrays are not all in the same orientation, the study shall address any impacts this may have on the overall system performance. Since the roof is flat the minimum slope shall be

- C. Shading Study: Provide a Google Earth shading study indicated all obstacles that could potentially shade the array. Include neighboring buildings, trees, overhangs, mechanical equipment, etc. Locate the array so that no part of the array is in the shade at any time.
- D. Submittal Documents:
 - 1. Prepare and submit complete engineering plans, specifications, and calculations for the solar photovoltaic system. Engineering work shall be in accordance with all laws and regulations applying thereto.
 - 2. Respond in writing to review of engineering documents made by Architect.
 - 3. Construction drawings:
 - a. Provide detailed drawings of the solar photovoltaic system and accessories with dimensioned locations of components and external connections and attachments.
 - b. Detailed point-to-point wiring diagrams showing each device and interconnections.
 - c. Floor plans and elevations showing equipment layout, dimensions and interconnecting conduit and wire.
 - d. Indicate mounting methods and grounding of solar panels and accessories.
 - e. One line Diagram
 - f. L&I submittal set.
 - 4. Design Calculations:
 - a. Electrical sizing calculations
 - b. Seismic restraint calculations
- E. Submit manufacturer's product data sheets for all equipment.
- F. Operating and maintenance manuals.
- G. Utility company rebate calculations and application forms for eligible items for Owner's application for rebate.

1.6 IDENTIFICATION

- A. Provide an identification nameplate for each photovoltaic inverter and each feeder overcurrent protection device.
- B. Provide additional markings and identification of equipment as required by NEC 690.14, and 690.51 through 690.56.

1.7 COORDINATION

- A. Coordinate layout and installation of PV system and accessories with other roof-mounted equipment. Array is installed on flat roof with racking system.

- B. Coordinate and communicate the final approved PV panel mounting conditions, orientation, and tilt angle with the project structural engineer. Coordinate final support detailing with structural engineer.
- C. Coordinate installation of equipment supports, and roof/wall penetrations. These items are specified in other Divisions of the specifications.
- D. Coordinate size and location of housekeeping bases and support points.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Operating Temperature: -20 degrees C to +50 degree C.
- B. All equipment shall be NEMA 3R enclosed.

1.9 WARRANTY

- A. The system shall be warranted as specified in the purchase agreement, but shall be no less than one year from the time of acceptance. The Solar Photovoltaic system manufacturer shall replace or repair any defective parts within the first year of operation at no extra cost to the owner.
- B. The photovoltaic panels shall be covered by the photovoltaic manufacturer's warrantee for a minimum of 25 years and shall be passed through the supplier to the customer.
- C. The inverter shall be covered by the manufacturer's warrantee for a period of not less than 10 years, and shall be passed through the supplier to the customer.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN MANUFACTURERS

- A. Photovoltaic Panels: Itek Energy, Candian Solar, LG, Sunpower, Panasonic, Solartech or equal
- B. Inverter Basis of Design: Solectria or equal
- C. Racking System Basis of Design: Dynoraxx Evolution or equal.
- D. Other manufacturers acceptable subject to submissions showing equipment meets or exceeds the basis of design manufacturers.

2.2 SYSTEM

- A. AC output voltage 277/480V, 3-Phase, 60Hz.

2.3 PHOTOVOLTAIC PANELS

- A. Requirements
 - 1. Minimum Efficiency: 18%
 - 2. Minimum Power: 340W
 - 3. Polycrystalline
 - 4. UL listed
 - 5. Tolerance of Pmax 0%/5%

6. Open Circuit Voltage (Voc) 29 V
7. Short Circuit Current (Isc): 10.90
8. Operating Temp: -40 to 85 C
9. Maximum System (DC) Voltage 1500 V
10. Fire Performance: Type 1 UL 1703
11. Series Fuse Rating 20 A
12. Class A application
13. Power Tolerance 0 - 5W
14. Anodized aluminum frame with tempered glass

2.4 INVERTERS

- A. Inverter enclosures shall be Nema 1, floor mount, 3 phase in Penthouse B
- B. Yaskawa Solecrica #PVI Series or equal, string inverters are acceptable
 1. NEC 2017 690.11 and 12
 2. Islanding protection to meet IEEE 1547 and UL 1741.
 3. UL Seismic Zone 4
 4. 5 year Warranty
 5. KW Rating: see alternates
 6. Power Factor Unity
 7. Maximum Input Voltage 1000 V
 8. Maximum Input Current: see alternates
 9. Output Voltage: 480Y/277 Volt, 3 phase, 4 wire
 10. Efficiency Greater than 96%
 11. THD less than 3%
 12. -22 to 140 F operation
 13. Less than 50Db sound rating
 14. Breaker
- C. Provide the following options
 - a. AC and DC disconnects.
 - b. PV ground fault protection system
 - c. PV combiner board
 - d. Lightning arrester AC/DC protection
 - e. Communications software

2.5 COMBINER BOXES

- A. Solectria #STRCOM 4X - Fused string combiner or equal

2.6 DISCONNECT SWITCHES

- A. Nema 4, heavy duty type

2.7 SAFETY FEATURES

- A. The system shall incorporate a maintained position on/off switch located on the enclosure. Under normal conditions, the on/off switch is in the on position. Turning the switch to the off position will initiate a controlled shutdown and open the A/C contactor within the unit. The A/C contactor shall not close unless the switch is in the on position. The inverter shall be prevented from being restarted until the on/off switch is turned back to the on position.

- B. The system shall be equipped with ground fault detection circuitry. Upon detection of 10 amps of ground fault current, the system shall execute an orderly shutdown, and annunciate a ground fault at the operator interface. The system shall remain faulted until the ground fault is remedied and cleared at the operator interface. There must be the only point of PV conductor ground.
- C. Anti-Island Protection: A digital phase-shift-loop (PSL) circuit shall be implemented in the inverter controller to prevent "islanding" of the system. In the event of a utility outage, these adjustments destabilize the feedback between the inverter and the remaining load, resulting in an over/under frequency or voltage condition. The system shall perform an orderly shutdown. The fault condition will remain until the utility voltage and frequency have returned to normal for 5 minutes.

2.8 MOUNTING

- A. Unirac Flat MetalX or equal with all accessories required for a complete mounting system. Array mounts on a flat roof with minimal slope of 10 degrees. Contractor shall provide a complete mounting system for all arrays, inverters, combiner boxes, and disconnects.
- B. Provide adequate space between panels rows for optimal efficiency. Minimum 19"
- C. UL2703 listed
- D. Contractor shall provide all ballast and wind calculations for the array.
- E. Provide all accessories necessary for a complete and fully functional installation

2.9 METERING

- A. Provide deduct meter base for use by PSE

2.10 WEB BASED MONITORING SYSTEM

- A. Equal to Solectria Solnrenview with Weatherstation
- B. Provide an internet based solar PV installation monitoring system that includes data acquisition system, real-time reporting software.
- C. Provide detailed operational inverter data (DC and AC) using a web enabled device. Provide daily, weekly, monthly, and annual graphs up to 5 years into the past, viewing single events or long-term performance trends. Provide e-mail and cell phone alerts with detailed descriptions of system issues and a recommended course of action.
- D. Provide real-time weather package showing accurate readings of crucial environmental information that affect the performance of the PV system. Provide a solar irradiance sensor as well as temperature sensors for ambient and module measurements.
- E. Output to third party monitoring. Coordinate with mechanical for interface to DDC system. Provide all modules required to interface and provide data to this system.
- F. Owner will furnish display monitor in the administration. Contractor shall install all software necessary to show display similar to below on monitor.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Connect and mount the complete photovoltaic installation per manufacturer's instructions.
- B. Coordinate with the distribution system Electrical Contractor for point of connection to the distribution system.
- C. Ship, store, and install products and materials in a manner that will protect them from physical damage, water damage, weather and entry of debris. If items are damaged in the opinion of the Architect, take immediate steps to obtain replacement or repair.
- D. Mounting: The array shall be mounted to the roof to withstand maximum winds of 110 mph. Obtain a structural engineers approval or proposed design

3.2 TESTING

- A. Photovoltaic modules shall be tested in factory for design performance.
- B. Inverter shall be factory tested for performance, and results shall be included in the O & M manual.
- C. System testing of installed photovoltaic array shall be performed on all system strings and recorded in the O & M manual.
- D. System start-up procedure will be as outlined by the manufacturer's installation manual and the inverter manual.

END OF SECTION 263100

SECTION 263233 – EMERGENCY ENGINE GENERATOR

PART 1 GENERAL

1.1 SCOPE

- A. Provide complete factory assembled emergency generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator. Existing inverter system is to be removed.
- B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.
- C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.
- D. Generator shall meet all EPA and current Washington state requirements for emissions.
- E. Provide engine star monitor contacts between generator and ATS
- F. Provide Manual Transfer Switch, breaker, and camlocks to meet NEC 700
- G. Generator will power elevator as accessible means of egress
- H. See protective device coordination study requirements. All equipment specified herein shall comply with the requirements of the study. All equipment shall be increased in size, electronic trip added, wire and conduit size increased as require to provide a complete selectively coordinated system. Nothing in the following specification relieves the contractor from providing a complete selectively coordinated system. Fuses shall not be used to provide selective coordination.

1.2 CODES AND STANDARDS

- A. The generator set and its installation and on-site testing shall conform to the requirements of the following codes and standards:
 - 1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - 2. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 - 3. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - 4. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

5. FCC Part 15, Subpart B.
 6. IEC8528 part 4. Control Systems for Generator Sets
 7. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 8. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 9. IEEE587 for voltage surge resistance.
 10. Mil Std 461D –1993. Military Standard, Electromagnetic Interference Characteristics.
 11. Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.
 12. NEMA ICS10-1993 – AC Generator sets.
 13. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 14. NFPA99 – Essential Electrical Systems for Health Care Facilities
 15. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
 16. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
 17. UL2200. The generator set shall be listed to UL2200.
- B. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

- A. Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based generator sets manufactured by Cummins or equal by Kohler or MTU Power.

PART 2 PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set shall be rated kW as shown on drawings at 208Y/120V Volt, 3 phase, 4 wire at 1800 rpm.
2. The generator set rating shall be based on emergency/standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

3. The diesel engine-generator set shall pick up a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 273 kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.2 ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be diesel, 4 cycle, radiator and fan cooled. Minimum displacement shall be per Cummins Standard. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:
- B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

- C. Generator shall meet EPA standards for low emissions.
- D. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H₂O external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
- E. Electric starter(s) capable of three complete cranking cycles without overheating.
- F. Positive displacement, mechanical, full pressure, lubrication oil pump.
- G. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
- H. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
- I. Replaceable dry element air cleaner with restriction indicator.
- J. Flexible supply and return fuel lines.
- K. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.
- L. Coolant heater
 - 1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
 - 2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The coolant heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
 4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.
- M. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
- N. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.
- O. Provide critical grade exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- P. A UL listed/CSA certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. The charger may be located in an automatic transfer switch, or may be wall mounted, at the discretion of the installer. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:
1. Loss of AC power - red light
 2. Low battery voltage - red light
 3. High battery voltage - red light
 4. Power ON - green light (no relay contact)
 5. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses.
- Q. Fuel Storage Tank
1. Provide a nominal dual wall diesel storage base tank. Tank and installation shall conform with NBFU 30. Tank shall be sized for minimum 72 hour operation at full load. Tank shall be base mounted with all fuel lines connecting to generator.
 2. Tank shall be provided with fill and vent lines, and with black iron supply and return lines. The fuel and return lines shall be looped near the engine. Provide all fuel lines necessary to connect
 3. The tank shall be equipped with a low fuel level alarm switch and fuel level gauge.
 4. Fill tank at substantial completion.
 5. Tank construction shall have integral secondary containment as per UL 142 listing
 6. Normal atmospheric vent shall not be less than 12 ft above adjacent grade, nor located for trapped vapors under eaves, and at least 5 feet from building openings or property lines per IFC 5704.2.7.3.3.
 7. The tank emergency vents shall not vent inside a building or weather housing, IFC 5704 2.7.4.2

2.3 AC GENERATOR

- A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.
- B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
- D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.4 GENERATOR SET CONTROL

The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

Start monitor contact to ATS

- A. Control Switches
 - 1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - 2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
 - 3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
 - 4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
- B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 0.5%.
2. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
3. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
4. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.
5. Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

C. Generator Set Alarm and Status Display.

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
 - a. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown).
 - b. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
 - c. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
 - d. The control shall include an amber common warning indication lamp.
2. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
 - a. low oil pressure (alarm)
 - b. low oil pressure (shutdown)
 - c. oil pressure sender failure (alarm)
 - d. low coolant temperature (alarm)
 - e. high coolant temperature (alarm)
 - f. high coolant temperature (shutdown)
 - g. high oil temperature (warning)
 - h. engine temperature sender failure (alarm)
 - i. low coolant level (alarm or shutdown--selectable)
 - j. fail to crank (shutdown)
 - k. fail to start/overcrank (shutdown)
 - l. overspeed (shutdown)
 - m. low DC voltage (alarm)
 - n. high DC voltage (alarm)

- o. weak battery (alarm)
 - p. low fuel-daytank (alarm)
 - q. high AC voltage (shutdown)
 - r. low AC voltage (shutdown)
 - s. under frequency (shutdown)
 - t. over current (warning)
 - u. over current (shutdown)
 - v. short circuit (shutdown)
 - w. ground fault (alarm) (optional--when required by code or specified)
 - x. over load (alarm)
 - y. emergency stop (shutdown)
- 3. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
 - 4. The control shutdown fault conditions shall be configurable for fault bypass.

D. Engine Status Monitoring.

- 1. The following information shall be available from a digital status panel on the generator set control :
 - a. engine oil pressure (psi or kPA)
 - b. engine coolant temperature (degrees F or C)
 - c. engine oil temperature (degrees F or C)
 - d. engine speed (rpm)
 - e. number of hours of operation (hours)
 - f. number of start attempts
 - g. battery voltage (DC volts)
- 2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

- 1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
- 2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
- 3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
- 4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field.
2. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
3. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
4. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
5. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
6. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
7. When required by National Electrical Code or indicated on project drawings, the control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.
8. The generator set control shall include a 120VAC-control heater.

G. Other Control Functions

1. The generator set shall be provided with a network communication module to allow BACnet/Modbus compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.
2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.
3. Provide Modbus/Bacnet output to the DDC system for remote monitoring

H. Control Interfaces for Remote Monitoring:

1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
2. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
3. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

2.5 OTHER EQUIPMENT TO BE PROVIDED WITH THE GENERATOR SET

- A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.
- B. The generator set shall be provided with dual mounted main line circuit breakers, sized per drawings. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

C. Outdoor Weather-Protective Sound Attenuating Housing

1. The generator set shall be provided with a sound-attenuated housing, Quiet Site Level 2, 72 dBA maximum, which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 73 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.
2. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.
 - a. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a raincap and rainshield.
 - b. All sheetmetal shall be primed for corrosion protection and finish painted with the manufacturers standard color. All surfaces of all metal parts shall be primed and painted.
 - c. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

2.6 AUTOMATIC TRANSFER SWITCH

- A. 4 pole, 120/208V-3 ϕ /4 Wire, of rating indicated. NEMA 1 enclosure, equal to Onan OTEC with Power Sentry Control including load break manual operation, solid state operation, adjustable dropout and pickup voltage, time delay start, time delay transfer, time delay retransfer, time delay stop, programmed transition, test switch for simulating power failure, elevator signal contact and associated time delay, auxiliary contacts NO NC, switch mounted battery charger, 7 day Solid State Exerciser Clock options. AIC Rated per drawings. Provide engine start monitor contacts per NEC 700

2.7 MANUAL TRANSFER SWITCH, NEC 700-3 BYPASS SYSTEM

A. Quality Assurance

1. Manual transfer switch shall be UL listed and labeled under the UL 1008 standard.
2. Manual transfer switch shall be special seismic certified by OSHPD exclusively on the basis of approved shake table testing, and also certified to IBC 2015. Minimum IBC 2015 design parameters shall be as follows: $I_p = 1.5$, $SDS = 2.0g$, $z/h = 1.0$
3. Manual transfer switch manufacturer shall provide a complete factory assembled, wired and tested manual transfer switch.
4. Manual transfer switch shall be factory Hi-pot tested for a period of not less than 60 seconds.
5. Manual transfer switch installation shall meet all applicable NEC standards
6. Manual Transfer Switch shall be 480 volt rated and 3 pole

B. Manual Transfer Switch

1. Shall be ESL Power Systems StormSwitch Series 3020 or alternate accepted equal.
2. Manual transfer switch shall consist of (2) two mechanically-interlocked molded case circuit breakers, cam-style male connectors, power distribution block and grounding terminals, all housed within a padlockable enclosure.
3. Manual transfer switch enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated galvalume steel. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure. Access for portable generator cables with female cam-style plugs shall be via a) drawn flange cable entry openings in the bottom of enclosure for wall mount units, or b) hinged lower door for pad mount units. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened. Enclosure shall be powder coated after fabrication; color shall be wrinkle gray RAL 7035.
4. Cam-style male connectors (inlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC. Cam-style male connectors shall be color coded. Cam-style male connectors shall be provided for each phase and for ground, and shall also be provided for neutral if required. Each of the phase cam-style male connectors within the enclosure shall be factory-wired to a molded case circuit breaker. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. The neutral cam-style male connectors, if required, shall be factory wired to a power distribution block. None of the cam-style male connectors shall be accessible unless both molded case circuit breakers are in the "OFF" position and the main access door is open.
5. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.
6. Molded case circuit breakers shall be UL Listed and the short circuit interrupt rating shall be a minimum of 35kAIC at 480VAC. Trip rating of the molded case circuit breakers shall be as shown on the drawings. One molded case circuit breaker shall be fed from utility power; the other molded case circuit breaker shall be fed from the cam-style male connectors to supply power from a portable generator. Both molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless both breakers are in the "OFF" position. Both molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The (2) molded case circuit breakers shall be safety interlocked by mechanical means to ensure that only one breaker can be closed at any given time.
7. Manual transfer switch shall be suitable for use as service equipment in the USA as defined by the NEC.

2.8 SPARE PARTS

- A. The following list of Spare Parts shall be furnished with the generator set and packaged in sets or pieces in sealed pouches (except for the glycol and paint) with parts description and parts numbers:
 1. Fuses -- One complete set for each set installed
 2. Lamps -- One complete set installed
 3. Fuel Filters -- One complete set of cartridges
 4. Oil Filters -- One complete set of cartridges
 5. Air Filters -- One complete set of cartridges
 6. Ethylene Glycol -- Five one-gallon containers
 7. Touch-up Paint - One quart
 8. Lubricating Oil -- One complete change/quart containers
 9. Coolant Hydrometer

10. Battery Hydrometer (if battery has opening for its use)
11. Fan Belt
12. Alternator Belt
13. Water Pump Belt

2.9 PAD

- A. Provide concrete pad under generator and enclosure extending 6 inches beyond foot print.

2.10 GENERATOR ANNUNCIATOR PANELS

- A. Generator Annunciator Panel shall meet NFPA 99. Onan series. Provide ATS Annunciator. Both located in the Custodial Office

2.11 MAINTENANCE SYSTEM

- A. Provide manual transfer switch, enclosure, and Kamlocks per NEC 700

PART 3 OPERATION

3.1 SEQUENCE OF OPERATION

- A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.
- B. The generator set shall complete a time delay start period as programmed into the control.
- C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
- D. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
- E. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
- F. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to

prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

- G. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous state.
- H. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
- I. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
- J. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

3.2 SUBMITTALS.

- A. Within 10 days after award of contract, provide six sets of the following information for review:
 - 1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.
 - 2. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
 - 3. Manufacturer's certification of prototype testing.
 - 4. Manufacturer's published warranty documents.
 - 5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
 - 6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
 - 7. Manufacturer's installation instructions.

3.3 FACTORY TESTING.

- A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.
- C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.4 INSTALLATION

- A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- D. Equipment shall be initially started and operated by representatives of the manufacturer.
- E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.5 ON-SITE ACCEPTANCE TEST:

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.
- B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.6 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 12 hours in duration and the class size shall be as designated by the owner.

Training date shall be coordinated with the facility owner. Videotape the session and deliver 3 copies of tape to owner in VHS format.

3.7 SERVICE AND SUPPORT

- A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.8 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 263233

SECTION 265100 – INTERIOR 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. USGBC LEED
 - 2. DLC – all fixtures shall have DLC label
 - 3. Lighting Design Lab listing
- 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.
 - 1. Include Samples of luminaires and accessories involving color and finish selection.
- G. Samples for Verification: For each type of luminaire.
 - 1. Include Samples of luminaires and accessories to verify finish selection.
- H. 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: Provide 1 for each fixture type except:
 - a. Provide (5) LED Driver/Power Supplies for RL-1
 - b. Provide (2) LED Driver/Power Supplies for PL-1
 - 2. LED Lamp Modules: Provide 1 for each fixture type
 - 3. Diffusers, louvers, and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each 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 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 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.

1.10 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

1.11 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 output 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 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 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 structure 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.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 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.

3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Fixture Lighting Controls."
- B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265100

SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 - GENERAL

- 1.1 This section specifies the furnishing, installation, and connection of exterior fixtures and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.
- 1.2 RELATED SECTIONS:
 - A. Section 03 30 00, CAST-IN-PLACE CONCRETE.
 - B. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.
 - C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
 - D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
 - E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
 - F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
 - G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.
 - H. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.
- 1.3 QUALITY ASSURANCE:
 - A. The installer shall be a licensed electrical contractor experienced in LED lighting fixture installations.
 - B. Thoroughly inspect site, existing electrical panels, and other related work
- 1.4 SUBMITTALS:
 - A. Shop Drawings:
 1. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
 2. Material and construction details include information on housing and optics system.
 3. Physical dimensions and description.
 4. Wiring schematic and connection diagram.
 5. Installation details.
 6. Energy efficiency data.

7. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
8. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
9. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
10. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
11. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point-by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.

B. Manuals:

1. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
2. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

C. Certifications: Two weeks prior to final inspection, submit the following:

1. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 LEED SUBMITTALS

A. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.

1. LEED Submittal Coversheet
2. Materials and Resources Submittals:
 - I. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 1. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. LRFDLTS-17 Structural Supports for Highway Signs, Luminaires and Traffic Signals
- C. American Concrete Institute (ACI):
1. 318-14 Building Code Requirements for Structural Concrete
- D. American National Standards Institute (ANSI):
1. H35.1/H35 1M-17 American National Standard Alloy and Temper Designation Systems for Aluminum
- E. American Society for Testing and Materials (ASTM):
1. A123/A123M-17 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 2. A153/A153M-16 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 3. B108/B108M-15 Aluminum-Alloy Permanent Mold Castings
 4. C1089-13 Spun Cast Prestressed Concrete Poles
- F. Federal Aviation Administration (FAA):
1. AC 70/7460-IL-15 Obstruction Lighting and Marking
 2. AC 150/5345-43H-16 Obstruction Lighting Equipment
- G. Illuminating Engineering Society of North America (IESNA):
1. HB-9-00 Lighting Handbook
 2. RP-8-14 Roadway Lighting
 3. LM-52-03 Photometric Measurements of Roadway Sign Installations
 4. LM-72-97(R2010) Directional Positioning of Photometric Data
 5. LM-79-08 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
 6. LM-80-15 Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
 7. TM-15-11 Luminaire Classification System for Outdoor Luminaires
- H. National Electrical Manufacturers Association (NEMA):
1. C78.41-16 Electric Lamps – Guidelines for Low-Pressure Sodium Lamps
 2. C78.42-09(R2016) Electric Lamps – Guidelines for High-Pressure Sodium Lamps
 3. C78.43-13 Electric Lamps – Single-Ended Metal-Halide Lamps
 4. C78.1381-98 Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps
 5. C81.61-17 Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps

6. C82.4-17 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
7. C136.3-14 For Roadway and Area Lighting Equipment – Luminaire Attachments
8. C136.17-05(R2010)(S2017) Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors
9. ICS 2-00(R2005) Controllers, Contactors and Overload Relays Rated 600 Volts
10. ICS 6-93(R2016) Enclosures

I. National Fire Protection Association (NFPA):

1. 70-17 National Electrical Code (NEC)
2. 101-18 Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

1. 496-17 Lamp holders
2. 773-16 Plug-In, Locking Type Photocontrols for Use with Area Lighting
3. 773A-16 Nonindustrial Photoelectric Switches for Lighting Control
4. 1029-94 High-Intensity-Discharge Lamp Ballasts
5. 1598-08 Luminaires
6. 8750-15.....Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.7 DELIVERY, STORAGE AND HANDLING:

- A. All materials are to be new and delivered to the site in an undamaged condition. Store materials off the ground and protect from damage.

PART 2 - MATERIALS

2.1 PATH LIGHTS

A. Acceptable Manufacturer:

FX Luminaire

U.S.A. Headquarters
1940 Diamond Street
San Marcos, CA 92078
Tel: (1) 760-744-5240
Fax: (1) 760-744-7461

Web: fxl.com

B. Model:

1. Model Number:

2. Finish: Power
3. Output: 3LEDT
4. Total Lumens: 74
5. Input Voltage: 10-15V
6. Input Power (w): 4.2
7. VA: 4.5
8. Efficacy (Lumens/Watt): 21
9. Color Rendering Index (CRI)
10. Max Candela: 29
11. Dimming: PWM, Phase **
12. Minimum Rated Life (L70)

C. Or approved equals.

2.2 LED DRIVERS

- A. LED drivers shall meet the following requirements:
1. Drivers shall have a minimum efficiency of 85%.
 2. Starting Temperature: -40 degrees C (-40 degrees F).
 3. Input Voltage: 120 to 480 ($\pm 10\%$) volt.
 4. Power Supplies: Class I or II output.
 5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 6. Power Factor (PF): ≥ 0.90 .
 7. Total Harmonic Distortion (THD): $\leq 20\%$.
 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.3 LIGHT FIXTURE MAINTENANCE LABELS:

PART 3 - EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:

1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

INSTALLATION:

- A. For Lighting Fixtures, the installer must be a licensed electrical contractor, experienced in lighting fixture installations.
- B. Fixtures shall be neatly and firmly mounted, using mounting hardware as directed in manufacturer's specifications and the Plans and Details.
- C. Install a photo-cell bypass switch for all applications where photocells are specified for outdoor lighting installations.
- B. Exterior lighting fixtures shall be constructed and gasketed to prevent entry of dirt and insects and damp or wet labeled as required.
- C. Provide reinforced concrete pole bases as indicated. Coordinate with concrete work. Verify exact location of light poles with Engineer prior to placement.
- D. Adjust photoelectric controls and time clocks/switches as directed by the Engineer.

3.3 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 275123 – PAGING SYSTEM

PART 1 GENERAL

1.1 SUMMARY OF WORK

- A. It is the intent of this Section in conjunction with the applicable Drawings to provide a POE based intercommunication system that is fully supervised. The System shall provide all of the features specified such as creating paging groups; ad-hoc, live or prerecorded audio broadcasts; administer broadcasts from a secure web interface or IP phone; message scheduling; and simultaneous broadcast to multiple paging groups.

1.2 WORK INCLUDED

- A. Provide all labor, materials, tools, and equipment for a complete and operational system as called for in the specifications and Drawings, specifically:
 - 1. Public address system amplifiers, zone controls, and back boxes.
 - 2. Public Address speakers, ceiling mounted, wall mounted horn, both interior and exterior. Speakers shall be POE devices that are fully compliant with NFPA 72 standards for supervision and emergency use,
 - 3. Volume attenuators as shown on the Drawings to adjust the speaker sound level. Emergency and fire alarm messages shall override volume control.
 - 4. Paging override signal to local sound systems. Coordinate with AV contractor
 - 5. Interactive Graphical User Interface (IGUI) to intercom functions including zone or all page, answering intercom call-ins, selecting and distributing program sources to predefined zones or all zones and facilitating single action activation of multiple system interface e.g. access control and CCTV or other systems as directed by Owner.
 - 6. All System configurations shall utilize Windows-based software. Proprietary software will not be accepted.
 - 7. The System shall have the hardware and software necessary to be connected to the Owner's local area network (LAN) to administer the system. This includes the ability to make bell schedule changes, architectural numbering changes, zoning changes, etc.

1.3 QUALITY ASSURANCE

- A. All major System equipment shall be of a single manufacturer, supplied and installed by an authorized factory distributor of the supplied equipment with full warranty privileges. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to the District. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the system Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.
- B. The Contractor's Technicians assigned to the installation and programming of the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of their submittal or to the Consulting Engineer before being allowed to commence work on the system.
- C. The System contractor shall have furnished and installed school intercommunication systems continuously for no less than five years.

- D. The manufacturer shall provide proof that the system is of a modular design and supported with software updates and improvements to the product. Systems that require major replacement of head-end equipment to upgrade their system will not be acceptable.
- E. The System shall be designed specifically for school applications. The System shall be installed by a contractor who has a minimum of three similar school communication systems currently installed and operating satisfactorily in Western Washington.
- F. The System contractor shall furnish and install all materials, even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all the specified requirements.
- G. All major components shall be listed with the Underwriter's Laboratories. No exception to this will be accepted.
- H. The System contractor shall guarantee availability of 24-hour local service by factory- trained personnel of the equipment manufacturer. The contractor shall have available stock of the manufacturer's standard parts.
- I. Acceptable manufacturers are Telecor or equal

1.4 FUNCTIONS – COMMUNICATIONS

- A. The System shall contain software and hardware for seamless integration between the telephone and intercommunication systems, and will allow access to all of the school related intercom features from the telephone system. The Contractor shall be responsible for coordinating interface requirements with the District IT department.
- B. The System shall utilize the Owner-provided VoIP telephones to access all intercom features. The System will be connected via Ethernet switches.
- C. The System shall be capable of configuring recipient groups by specifying the parameters. Coordinate actual configuration with District prior to installation.
- D. The System shall be capable of programming privileges by user.
- E. The system shall provide office or classroom exclusion of loudspeakers from all-call, audio programs, and class change signals to allow for privacy during tests and meetings.
- F. Calls to the classroom will provide for calling the loudspeaker for hands-free answer back intercommunication. The system shall provide single-step transfer from loudspeaker to private handset communication. Systems that restrict or prevent this feature will not be acceptable.
- G. Provide software for Owner supplied workstations.

1.5 IN SERVICE TRAINING

- A. The Contractor shall furnish a minimum of eight hours of in service training with the system. These sessions shall be broken into segments that will facilitate the training of individuals in operating station equipment, administrative devices, user programming functions, and program distribution equipment. Operating manuals and users guides shall be provided at the time of the training.

1.6 MAINTENANCE SERVICE

- A. The Contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or engineer.
- B. A maintenance contract offering continued factory authorized service of this system shall be made available if requested by the Owner.

1.7 SUBMITTALS

- A. Data sheets shall be provided on all equipment being provided.
- B. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and all provisions available and made for adaptability of all specified future functions and including all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and material shall carry Underwriters Laboratory certification if required by local, state or national codes.
- B. Manufacturer: School Intercom System is Telecor E Series with a Singlewire Informacast overlay to connect with other schools in the district. Provide all licenses for the system.
- C. System shall have on site controller to allow system to function completely with the loss of the WAN connection
- D. UPS shall be provided to keep intercom system functioning for minimum 1 hour after power failure
- E. System shall be fully supervised, no analog devices shall be used
- F. System shall provide for IP access to the Telecor intercom programming and Singlewire wide area network programming.
- G. System shall provide for eSip phone integration to the owner's phone system

2.2 HEAD END

- A. Telecor E Series for a complete and fully functional system
 - 1. Main system controller for redundancy and operation when WAN connection is lost
 - 2. E300 Console Administrative Console as needed
 - 3. ECI Control Interface
 - 4. Esip Telephone Interface
 - 5. EDesktop 1.1
 - 6. EAM Alarm manager
 - 7. Master Clock
 - 8. Eport management interface
 - 9. EMH Package

2.3 FUNCTIONS – AUDIO PROGRAMMING

- A. Transmit audio program from the multimedia control center to any one, several, or all loudspeakers simultaneously.
- B. Provide software selection of audio program to any room station, individual zone, group of zones, or all zones.
- C. Aurally monitor a program either before or during distribution.

2.4 SOFTWARE

- A. Basis-of-design – Provide one of the following products:
 - 1. Telecor E Series for Local School
 - 2. Singlewire® InformaCast for Wide Area Network
- B. The intercommunication software shall be capable of provided all the required features and interfacing with other systems.
- C. Web Interface – The System shall be able to be programmed completely from a web interface that can be accessed through any typical web browser such as Microsoft Internet Explorer, Chrome, or Mozilla Firefox. The interface shall allow the user to program all features.
- D. The system shall provide for multiple user management.
- E. Provide redundant rack-mounted servers running the latest version of Windows that meets or exceeds the system hardware requirements. Servers shall be configured for hot-standby operation.
- F. The system shall include zone controller to integrate non-IP analog clocks.

2.5 INDOOR WALL MOUNTED SPEAKERS

- A. Manufacturers
 - 1. Telecor ES8 – TB Talkback in all classrooms, offices, conference rooms
 - 2. Telecor ES8 in hallways, restrooms
 - 3. Approved Equal
- B. Description: Factory assembled loudspeaker and baffle with / control board securely mounted to the rear of the baffle via concealed weld studs. The amplifier / control board shall be capable of producing 9 Watts RMS into the 8Ω loudspeaker with 9VDC minimum power provided by PoE switches. Interconnection on POE based devices shall be via a board mounted female RJ-45 connector. The loudspeaker shall be a dual cone 8" (205mm) loudspeaker with a 10oz (260g) ceramic magnet. The metal baffle shall be constructed of 18-gauge CRS. The baffle shall be finished in neutral white electrostatic powder coat. All speakers mounted in gymnasium spaces shall be covered with a protective cage.
- C. Flush Mount Enclosures: Flush mount enclosure shall be from same manufacturer as speaker. The enclosure shall include a slot style mounting system to accommodate almost any material thickness. The enclosure shall be constructed of 20-gauge CRS and finished in powder coat finish.

- D. Provide ceiling and wall mount white baffles and tile bridges. Gym shall have vandalproof baffle.
- E. Music rooms, Gym, and Commons shall have flashing indicator light integrated into the speaker

2.6 EXTERIOR WALL MOUNTED SPEAKERS

- A. Manufacturers
 - 1. Telecor ES8
 - 2. Approved Equal
- B. Unit shall be same as above except in vandal- resistant housing. Audio power capability may be increased as required for exterior coverage.
- C. Flush Mount Enclosures: Flush mount enclosure shall include external mounting wings to allow for installation into stud material. The enclosure shall be constructed of 18-gauge stainless steel.
- D. Provide weatherproof vandal resistant baffle

2.7 ACCESSORIES

- A. Call Switch: Telecor E Sereis, IP, 2 button "Push to Call" and "Emergency"
- B. Volume Control: Telecor ECS-5

2.8 ETHERNET SWITCHES

- A. Provide Cisco Ethernet switches to support the system plus 15% spare

2.9 UNINTERRUPTABLE POWER SUPPLY

- A. Provide a UPS for the system to allow normal operation and function for a minimum of 60 minutes. APC SmartUPS Online

2.10 CABLING

- A. All IP data cabling provided under 271500
- B. All other cabling as required by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Boxes, equipment, speakers, clocks, etc shall be installed plumb and square.

- C. Do not support speaker enclosures with lay in tiles or gypsum wall board. Provide adequate support for back-boxes so that no perceptible sag will occur once speaker and grille are mounted.
- D. All installation shall be done in a neat and workmanlike manner.
- E. Configure software to meet specified functionality and provide a fully functional and operational system.
- F. System shall be rack mounted in the MDF and IDF
- G. Clock headend equipment shall be installed in MDF
- H. EConsole as directed by owner

3.2 CABLING

- A. Cabling to support the System shall be as required by the manufacturer.
- B. IP/POE cabling provided in 271500

3.3 START-UP

- A. Review test reports prior to starting speaker and clock installation
- B. Review all station numbers with the owner prior to final programming
- C. Install Telecor software with IP interface complete. Confirm functionality with the owner
- D. Program and synchronize all clocks complete. Connect master clock to master system
- E. Install singlewire WAN software connected to all other Telecor systems in the district
- F. Connect owner's phone system

3.4 INSTRUCTION AND SYSTEM MANUALS

- A. A minimum of two four hour sessions shall be included for instruction of the personnel designated by the Owner as to the correct operation of the system. One additional four hour follow-up session will provide 6 months after system acceptance.
- B. Provide system training to Owner which addresses all phases of operation including:
 - 1. System programming from local PC using a networked connection from the Main Office of the building.
 - 2. Remote access methodology
 - 3. Build standard daily schedule for purposes of test and verification of operation.
- C. Upon completion of the installation, the contractor shall furnish the Owner with six system operation manuals.
- D. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming, station use, and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals.

- E. Provide two follow-up sessions of one hour each as requested by the Owner. These sessions shall be within 60 days of system acceptance.

3.5 WARRANTY

- A. A five-year manufacturers warranty shall be provided covering all intercommunications system head-end components, speakers, secondary clocks, and software. A ten-year warranty on all other equipment and the installation of the system shall also be provided. A copy of the warranty shall be submitted in writing with system documentation.

END OF SECTION 275123

SECTION 281300 – ACCESS CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Introduction

1. The contractor shall provide, install and program a functionally complete integrated Digital Alarm Communicator Transmitter (DACT) per Manufacturer's guidelines, codes described and these specifications. Provide a new D9412G Security Panel and Access Control System with a new Bosch Ready Key Pro Access Control System.

- B. Provide all equipment required, whether specified herein or not for a complete and fully functional Security System and Access Control System. Integrate the two systems and provide for connection to existing Security Devices.

- C. The system shall be fully IP compliant.

1.2 GENERAL CONDITIONS

A. Submittals

1. Specification Sheets: Specification sheets (cutsheets) of all proposed equipment shall be provided.
2. Equipment List: An equipment list shall be provided identifying:
 - a. Model number of each unit
 - b. Quantities of each type of device
 - c. Unit costs
3. Specification Compliance
 - a. A letter shall be submitted with the bid responding to specification subsections individually, indicating exceptions, substitutions and alternates. The Contractor shall submit requests for substitutions (as well as relevant technical data pertaining to the substituted equipment) to the Engineer 10 days prior to the close of bid for evaluation and approval. For substitution requests refer to section 012500.
4. Drawings
 - a. Shop drawings shall be provided giving details of proposed system architecture and the work to be provided. These include point-to-point drawings of systems and individual device wiring diagrams.
5. Permits
 - a. The Contractor shall be responsible for identifying requirements for permits from the local Fire and/or Police departments for the installation of the alarm system specified herein and shall assist the engineer in obtaining the relevant alarm permits.

B. Documentation to be Submitted by the Contractor upon Completion of System Installation

1. As-Built Drawings

- a. Upon completion of installation, the Contractor shall prepare "as-built" drawings of the system. These as-built drawings shall be 30" x 42" format, mylar reproducible drawings of each floor plan indicating exact device locations, panel terminations, cable routes and wire numbers as tagged and color coded on the cable tag. Additionally, final point-to-point wiring diagrams of each type of device (on 30" x 42" format) shall be included in the as-built drawings. As built drawings shall be submitted to the Engineer for approval prior to the system acceptance walk-through.

2. Operation and Maintenance Manuals

- a. Three (3) sets of operating manuals shall be provided explaining the operation and maintenance of the system.

C. Training

1. On Site Security Personnel Training

- a. Training in the complete operation of all systems shall be furnished by the Contractor upon completion of installation. Provide a minimum of 16 hours of training on the system. Record the session and provide a DVD of the session to the engineer.

D. System Approvals

1. Standard Product

- a. The system shall be the standard product of one manufacturer, and the manufacturer shall have been in business manufacturing similar products for at least five years.

2. Installing Contractor

- a. The Contractor shall be a factory-authorized and trained dealer of the system and shall be factory-trained and certified to maintain/repair the system for a minimum of 5 years after system acceptance.

E. Quality Assurance

- 1. All equipment, systems and materials furnished and installed under this section shall be installed in accordance with the applicable standards of:

- a. National codes: NEC, NFPA, UBC, BOCA, SBCCI
- b. Approvals and listings: UL, FM, (CSFM, NYC-MEA, when applicable)
- c. Local authorities having jurisdiction

F. Warranty

- 1. All components, parts and assemblies supplied by the Manufacturer and installed by the Contractor shall be warranted against defects in material and workmanship for a period of at least 12 months (parts and labor), commencing to start upon substantial completion. Warranty service shall be provided by a qualified factory-trained service representative.

G. Service/Maintenance

1. Repairs During Warranty Period
 - a. System maintenance and repair of system or workmanship defects during the warranty period shall be provided by the Contractor free of charge (parts and labor).
2. Periodic Testing
 - a. Periodic testing of the system shall be carried out on a monthly or quarterly basis to ensure the integrity of the control panel, the sensing devices and the telephone lines.
3. Timeliness
 - a. The installer shall initiate corrective action for any system defect within six (6) hours of receipt of call from the Engineer.
4. Extended Service/Maintenance Agreements
 - a. Extended service/maintenance agreements shall be offered by the Contractor for up to four years after the warranty expires. The agreement shall be renewable monthly, quarterly or yearly.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. The Digital Alarm Communicator and separate Access Control System (DACS) specified herein shall include a Digital Alarm Control/Communicator, built-in telephone line monitor, up to 1000 event memory logger, real-time clock, calendar, test timer, alarm verification, battery charging/voltage supervision circuitry, battery lead supervision, diagnostics displays, time/event-based scheduling system, lighting/EMI protection circuits and the associated optional modules and components for a complete DACS.
- B. System shall integrate the Security and Access Control Systems and be Internet Protocol (IP) Capable.
- C. The following describe the general functional requirements of the DACS:
 1. The DACS shall provide identification and reporting of intrusion devices.
 2. The DACS shall provide identification, annunciation and communication of alarmed detectors and switches by point. The system shall be fully addressable
 3. The DACS shall be capable of segregating the points (such as a detector or group of detectors zoned together) into separate, independent "areas." Gym shall be a separate partition on the system
 4. The DACS shall be "modularly" expandable using hard-wired address identification modules.
 5. The DACS shall have electrically supervised detection loops and power supplies (mains and battery(s)). This supervision shall be programmable for the purposes of reporting information to the DACR.
 6. The DACS shall be capable of monitoring and switching to a functional telephone line when trying to establish communications with the DACR and transmitting a report.

7. The DACS shall be capable of reporting and communicating alarm or trouble-event data by reporting to one, two or three off-site remote DACRs via dial-up analog telephone lines.
8. The DACS shall be capable of sending (manually or electronically) test and status reports to remote DACRs.
9. The DACS shall be programmable locally or remotely. Programming shall be accomplished using a portable programmer or a computer running the Remote Programming Software (RPS) or via the Internet Protocol device..
10. The DACS shall annunciate alarm, trouble, service reminders and other relevant system status messages in custom English text at the Alarm Command Centers (ACCs).
11. The DACS shall be capable of executing diagnostics and testing functions locally or remotely.
12. The DACS shall be capable of activating 128 relays for auxiliary functions based on its classifications (area vs. panel-wide). Relays shall be programmable to follow one or more alarm or supervisory points.
13. The DACS shall be capable of controlling relays and automatically executing system functions based on a time/event scheduling program. The program can be hour, day-of-week or day-of-month based. The following functions can be executed:
 - a. Arm/Disarm a specific area
 - b. Bypass/Unbypass a point
 - c. Activate/Deactivate a relay
 - d. Send a test report
 - e. Execute a custom keystroke function
 - f. Adjust system clock for daylight savings time

2.2 SYSTEM FEATURE/CAPABILITY SUMMARY

The subsections that follow specify system software/hardware capabilities, capacities and formats.

A. Number of Loops/Sensors

1. The system shall include 246 separately identifiable points, of which eight are on-board loops and 238 are offboard addressable points/zones connected to multiplexed back bone trunks. Each of the eight on-board points and 238 addressable points shall be capable of supporting "group zoning". Group zoning refers to the combining of sensors into a separately identifiable and separately annunciated (programmable text) area.

B. Programming Point Functionality

1. For each point in the system, the following characteristics shall be programmable:
 - a. Always on (24 hour response)
 - b. On when the system is Master Armed
 - c. Only on when the system is Perimeter Armed
 - d. Displays/does not display at the ACC when the point is activated
 - e. Provides/does not provide entry warning tone
 - f. Sounds/does not sound audible alarm indication
 - g. The point is bypassable/not bypassable
 - h. Alarm verification with programmable verification time
 - i. Summary relay activation by point
 - j. Provides/does not provide "Supervisory point" capability
 - k. Provides/does not provide "watch point" capability
 - l. Arms or disarms the area to which the point is assigned when the input changes states

C. Areas/Accounts

1. The DACS shall support eight (8) independent areas. Each of the eight areas shall have custom text associated with the armed state, the disarmed state and the point-of-normal state. Additionally, the DACS shall be capable of assigning a unique account identifier to each of the areas, depending on the distribution of areas per account.
2. The DACS shall be capable of logically grouping one or more points into an area, or conversely, dividing the 246 points into one or more areas.
3. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.
4. Areas shall be independently controlled by their corresponding ACCs. Each ACC can be designated to control a specific area, or group of areas, or all areas in the system.
5. Independent control or relay functions by area shall be possible through programming assignments.

D. Number of Alarm Command Centers

1. The system shall accommodate 32 ACCs, each capable of displaying custom English text on vacuum florescent displays and sounding different patterns of audible alarm for different events. Up to eight (8) ACCs shall be capable of being supervised at one time.

E. Number of User Passcodes

1. Up to 249 different passcodes shall be possible. Each passcode shall be three (3) to six (6) digits (variable).
2. Passcodes shall be enabled or disabled by area(s) and shall be assigned one of 14 different authority levels to carry out functions such as the activation of relays from the ACC. These passcodes shall also be required for carrying various system functions such as arming the system, disarming the system, transmitting a duress code, resetting the system and silencing sounders.

F. Communication Formats

1. The Radionics Modem IIIa² format shall be utilized for optimum system performance. The DACT shall report to a Commercial Central Station using a Bosch Security Systems D6600 Alarm Receiver that supports the Radionics Modem IIIa² communication format. The D6600 shall provide point identification information transmission to DACRs (Alarms, Troubles and Restorals by point). It shall also provide the actual point number, point text, actual user number, bypassed points, relay activation, opening/closing reports by up to 249 users, late, early, or fail opening/closing reports and opening/closing reports by area.

G. Testing, Diagnostic and Programmable Facilities

1. Automatic test reports and remote system access for diagnostics, programming and log (Logger) uploads shall also be supported via a remote central station computer utilizing RPS.

H. Logger Capacities and Formats

1. The system shall be capable of logging up to 1000 events indicating time, date, type of event, account number, area number, user ID, point text and primary/secondary telephone number called for each event. Logs shall be viewed locally at the ACC and remotely via an upload to a computer running RPS software. The DACS shall also support the printing of these events on up to three local parallel printers. The DACS shall also send a report to the DACR when the

log reaches a programmable "percent full capacity" so that RPS can retrieve the stored events.

2. Events shall be routed to specific printers by group, signal type and area.

I. Reports

1. Reports to DACRs at commercial central stations as a result of system supervision shall include alarm, trouble, missing modules, restoral, system status, AC failure and low battery. The DACS shall also transmit test reports once every 24 hours. CPU failure shall be annunciated locally. The ACCs shall display the following information for the system supervisory conditions:

- a. Call for service
- b. Service panel
- c. Service Param
- d. Service AC Fail
- e. Service Battery Low
- f. Service Battery Missing
- g. Service Communication Failure
- h. Service Keypad
- i. Service Phone Line 1
- j. Service Phone Line 2
- k. Service Printer
- l. Service Point Bus Failure

J. Telephone Lines, IP Addresses, and "Phone Routing"

1. The DACS shall support one (1) or two (2) telephone lines that are to be alternated for the transmission of consecutive events. The DACS shall have the capability of communicating with up to eight (8) different DACRs (4 different phone numbers) and/or four (4) different IP Addresses. Each phone number can be up to 24 digits long. The DACS reports shall be classified into eleven (11) subcategories or "report groups". Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled to be transmitted. Each DACR shall be designated as a primary, backup or duplicate destination for each report group. The transmission of events allows the reporting of different types of information to different remote DACRs. The twelve report groups shall be as follows:

- a. Fire Reports
- b. Burglar Reports
- c. User Reports
- d. Test Reports
- e. Diagnostic Reports
- f. Relay Reports
- g. Auto Function Reports
- h. RAM (RPS) Reports
- i. Point Reports
- j. User Change Reports
- k. Access Reports

K. Number and Programmability of Relay Output Modules

1. Eight (8) relays (Form C) shall be provided per octo-relay module for a possible total of 128 relays per DACS. These multipurpose modules shall be programmable and shall be used to implement auxiliary functions (manually or automatically). Relays shall be capable of being

programmed to follow up to 12 different area conditions or up to 12 panel conditions. Relays shall also optionally be programmed to follow individual points or groups of points.

L. Number and Alarm Output Selections

1. Four (4) different types of alarm output selections shall be supported by the DACS: Steady, Pulsed, California Standard and Temporal Code 3.
2. The system shall be capable of being configured to provide zoned indication of alarm conditions.

M. Miscellaneous Features

1. Miscellaneous features shall include:
 - a. Programmable alarm output timer per area
 - b. 31 programmable entry delay times
 - c. Exit delay programmable by area
 - d. Individually programmable point-of-protection text
 - e. Point bypassing
 - f. Keyswitch arming capability with LED outputs

N. Real-Time Clock, Calendar and Test Timer

1. The FDAC system shall incorporate an integral real-time clock, calendar and a test timer.

O. Opening and Closing Windows

1. The system shall be programmed with "normal" opening and closing periods for each day of the week and thus suppress scheduled opening/closing reports and report only the exceptions, that is, openings and closings outside the predefined time window. The DACS shall have the capability of suppressing opening and closing reports, overriding the programmed open and close windows during holidays and automatically arming the DACS (by area) at the end of the closing period.

P. DACS 24 Volt Power Rating

1. The DACS shall provide 4 amps of auxiliary power for use with initiating and indicating devices. Additional auxiliary power shall be provided by adding D9142 power supplies.

Q. DACS Power Ratings

1. The DACS shall provide 1.4 amps of auxiliary power and 2 amps of alarm power, both rated at 12 VDC.
2. Additional auxiliary power shall be provided by adding battery/charger modules up to a maximum of 2 amps.

R. DACS Fault Detection

1. The DACS shall check the point sensor loops once every 300 milliseconds. The point response time is programmable over a range of 300 milliseconds to 4.5 seconds.

S. User-Programmable Features

1. The DACS shall provide a "user-friendly" interface for programming/customizing the system to the operational criteria of the application. The DACS shall be capable of being operated through either:
 - a. The Command Structure
 - b. Menu/Command List
2. These system features shall have restrictions based on 14 individually programmable levels of passcode authority that can be assigned to system users. The user's passcode shall have the capability of being assigned a different authority level in each of the eight (8) areas. There shall be the capability to assign a Service passcode to the servicing agent allowing that agent limited access to system functions.

T. User-Programmable/Activated Functions

1. User-programmable/activated functions shall include:
 - a. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode and arming the system with a duress passcode.
 - b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
 - c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
 - d. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activate relays, initiate the remote programming function locally to allow programming the system from a remote location. The ACCs can also be temporarily readdressed to view the status of a remote area.
 - e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote DACR to check the telephone and/or Ethernet link and programming the time and date for the next test report transmission.
 - f. Change system parameters: ACC display brightness, system time and date and add/delete/change passcodes.
 - g. Extend the closing time of system.
 - h. Transmitting special alerts and activating audible and visible signals.
 - i. Executing multiple commands/ACC keystrokes from a single Menu/Command List item. This function shall be able to have a 16-character (alphanumeric) title to identify it on the ACC display.
 - j. Editing of time/event based scheduling program from the ACC.
 - k. The DACS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number and defaulting (toggling) text displays between custom and default text displays for troubleshooting.

2.3 SYSTEM INTERFACE REQUIREMENTS

A. Grounding

1. The Contractor shall properly earth ground the DACS to prevent electrostatic charges and other transient electrical surges from damaging the DACS panel.

B. Primary Power

1. The Contractor shall provide a dedicated 120 VAC power circuit to the DACS. This circuit shall be connected to the emergency power system. The 120 VAC is stepped down to 16.5 VAC

power the DACS panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.

C. Primary Power Supervision

1. When the primary power source fails, the system shall be capable of reporting an "AC Fail" message to a commercial central station. The transmission delay of this message shall be programmable from 1 to 90 minutes or 1 to 90 seconds. There shall also be an option to program the message to "tag-along" with another message transmitted to the central station. The system shall always display a loss of primary power on the ACC and may be configured to provide additional audible warning.

D. Secondary Power (Standby Battery)

1. The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 985 and 864 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity. The NFPA 72 criteria are as follows:
2. The Contractor shall provide standby battery power to support 24 hours of continuous operation in case of 120 VAC power failure in accordance with the following:
 - a. Central Station or Local: Standby battery power to support 24 hours of continuous operation in case of 120 VAC power failure and standby power to support five (5) minutes of alarm operation at the end of the 24-hour period.
 - b. Auxiliary or Remote Station: Standby battery power to support 60 hours of continuous operation in case of 120 VAC power failure and standby power to support five (5) minutes of alarm operation at the end of the 60-hour period with a 48-hour recharge time.

E. Secondary Power Supervision

1. When the secondary power source experiences an 85% depletion of its standby capacity, there shall be an optional capability to report a "Low Battery" message to a commercial central station. The system shall always display a low battery condition on the ACC and may be configured to provide additional audible warning.

F. Wiring

1. The Contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:
 - a. Wiring shall be appropriately color-coded with permanent wire markers. Solid copper conductors shall be used.
 - b. All signal cables provided under this contract shall comply with the applicable sections of the National Electrical Code (NFPA 70). Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.
 - c. Data wiring shall not be enclosed in conduit or raceways containing AC power wires.
 - d. Where EMI may interfere with the proper operation of the DACS circuits, twisted/shielded cable shall be used.

G. EMI/Lightning Protection

1. The DACS shall be protected from EMI and lightning surges.

H. Telephone Interface

1. The DACS shall be equipped with a phone-line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection to the DACS panel. When a telephone line is determined to be out of service by the DACS panel, the event shall be annunciated locally on the ACC and transmitted to the central station. The transmission delay of this message shall be programmable from 10 to 240 seconds. A telephone line switching module shall be used to interface to a second telephone line. This interface shall conform with FCC rules part 15 and 68.

I. Ethernet Interface

1. The DACS can use an Ethernet interface module as the primary means of communicating to a DACR. Up to four IP Addresses shall be available to route system events to. A programmable supervision time of 5 to 65,535 seconds shall be required.

J. Auxiliary Function Control Interface

1. Auxiliary functions such as activating bells, strobes or lights shall be accomplished using the optional relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damages.

K. Battery Backup of Programming and Restrictions on Number of Programmers

1. Functional criteria programmed into system memory shall be backed up by battery power. Additionally, the number of system programmers shall be severely restricted using program-locking features and passwords.

2.4 MATERIALS

The subsections that follow describe the system hardware.

A. DACS (Digital Alarm Communicator and Access Control System)

1. The DACS shall be provided, at a minimum, with the components listed below. Additional accessories shall be provided based on the quantities and features required for the application.
 - a. Enclosure
 - b. Lock and key
 - c. Faceplate shield
 - d. Power transformer
 - e. Manuals
2. The DACS control panel shall be Bosch Security Systems model D9412G

B. System

1. The system shall include the following accessories:
 - a. Accessory Description

- b. Provide all modules, power supplies, batteries popits, etc. for a fully functional addressable security system. System may be wired Class B. Provide relays as required for remote control. Provide for connection to UL monitoring system and provide for internet protocol (IP) connections

C. Communication Accessories

- 1. The system's communication accessories shall include the following:
 - a. Accessory Description
 - b. D928 Dual telephone line module - Alternates event transmission to Central Station between primary and secondary phone lines. Transmits over other phone line when first phone line is determined to be inoperable. Periodically tests phone line for usage and integrity and reports to central station when phone line is faulty. Remembers faulty line and transmits over operational line.
 - c. D161 8-foot phone cord
 - d. D162 2-foot phone cord
 - e. D166 RJ-31X Phone Jack
 - f. D9133TTL-E Ethernet Interface Module

D. Security Devices

Door Switches: As required for door type. See hardware schedule

ZX835	PIR/Microwave Detector, 35 ft. (11 m), with built-in POPIT
ZX970	PIR/Microwave Detector, 70 ft. (21 m), with built-in POPIT
D9133T TL-E	Ethernet Interface Module
D1255	Keypad: Alarm Command Center (ACC) - Built-in multi-tone sounder. Displays status in custom English text on 16-character display. If more than 4 ACCs are required, add D8132 battery charger unit. ACCs provide "command menu" user interface. ACC can be supervised. Model D1255R for red color, D1255W for white, D1255B for Gray.

E. Access Control System

- 1. Bosch Ready Key Pro with Server Licenses.
- 2. ReadyKey Pro hardware shall communicate over local-area or wide area networks (LAN-or WAN), TCP/IP, RS-232, RS-485 per port, and dial-up communications.
- 3. Intelligent System Controllers (ISC) shall connect to a combination of up to 16 devices. Dual and single reader interfaces, input control modules and output control modules shall communicate with the Intelligent System Controller over a 4000 ft per port RD-485 wire buss. The ISC shall use a 32 bit processor to command all downstream modules using a 38.4 kbps communication.
- 4. Card Readers:
 - a. Provide BOSCH iClass Switch Plate Readers (Model Number: ARD-R40). Provide controllers as required for a fully operation system.
- 5. Electric Locks – See Hardware Specification

6. Request to Exit - Bosch
 - a. DS150i Request to Exit Detector (DS151i in grey color)
 7. Key FOB's
 - a. Provide BOSCH ACT-IC16K26 (Quantity 500)
 8. Key Card:
 - a. Provide BOSCH ACA-IC2K26 (Quantity 500)
 9. Software:
 - a. System shall include Readkey Pro Software configured to interface with Issaquah School District Access Control data base.
 10. Interface with Security System:
 - a. Interface with the BOSCH: 9412 G series security panel – See Security Specifications use the following control equipment:
 - 1) E-NET interface for G Series Security Panels (Model Number: BOSCH DX4020)
 - 1) Remote Receiver - Inovonics: (Model Number: BOSCH FA400)
 - 2) Remote Receiver Interface: (Model Number: BOSCH d8125INV)
 - 3) Card Reader Interface: (Model Number: BOSCH D9210BLC) -26 bit reader interface.
- F. RF SUBSCRIBER UNIT – (Fire Alarm Communicator) Equipment:
1. Provide AES IntelliNet RF Subscriber Unit 7750 F
 2. Radio – Standard CSAA frequency ranges” 450-470 MHZ and 130 – 174 MHz VHF and UHF. Power out put shall be 2 watts
 3. Alarm Signal Inputs: 4 individually programmable Zones with NO/NC/EOS, Trouble restore and RS-232
 4. AC Status: Report to central station after no more than 4 minutes with out AC power.
 5. Report AC power restored after no more that 4 minutes after AC power is restored.
 6. Battery: Provide backup battery 12v at 7AH
- G. Battery Backup
1. Provide for complete battery backup of all systems with minimum 25% spare capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment and materials in accordance with the current recommendations of the manufacturer. The work shall also be in accordance with the following:
1. Installation criteria defined in these specifications and in the construction documents
 2. Approved submittals
 3. Applicable requirements of referenced standards

3.2 SUPERVISION

- A. The Contractor shall provide the following services as part of the contract:
 - 1. Supervision of subcontractors
 - 2. Coordination of other contractors for system-related work (electrical contractor, finish hardware contractor, Consultant and general contractor)
 - 3. Attending site construction/coordination meetings
 - 4. Keeping updated construction drawings at the construction site
 - 5. Meeting construction deadlines per the construction schedule

3.3 PROGRAMMING

- A. Programming of the system shall include the following tasks:
 - 1. Programming system configuration parameters (hardware and software, zone/circuit numbers, communication parameters)
 - 2. Programming operational parameters such as opening/closing reports and windows, system response text (custom English) displays of events, activation of relays that drive auxiliary devices and identifying types of zones/loops
 - 3. Programming passcodes according to the authorities and functions defined by the engineer
 - 4. Programming interface with CCTV system.
 - 5. Other system programming tasks required by the engineer. These additional programming requirements shall be coordinated between the engineer and the contractor.

3.4 TESTING

- A. Operational Testing
 - 1. The contractor shall perform thorough operational testing and verify that all system components are fully operational.
- B. Hard-Copy System Printout
 - 1. The contractor shall submit a hard-copy system printout of all components tested and certify 100 per cent operation indicating all devices/panels/units have passed the test criteria set forth by the manufacturer.
- C. Acceptance Test Plan Form
 - 1. An acceptance test plan form shall be prepared/provided by the contractor prior to the acceptance walk-through. This form shall include separate sections for each device/panel/unit as well as a column indicating the manufacturer's performance allowance/margin, a column indicating the result of the testing performed by the contractor (pass/fail), and an empty column for recording findings during the walk-through.

END OF SECTION 281300

SECTION 281600 – INTRUSION DETECTION

PART 1 - GENERAL

1.1 PURPOSE

- A. The Burglary Detection, Alarm and Communication (Security System) specified herein is intended to assure protection of valuable property. This specification references manufacturers' guidelines and general requirements that shall be complied with to ensure the proper and reliable functioning of the system.

1.2 SCOPE OF WORK

- A. Provide Security Panel and devices as indicated on plans. System shall be of Bosch Manufacturer.

1.3 GENERAL CONDITIONS

- A. Submittals/System Documentation:

- 1. Specification sheets (cutsheets) of all proposed equipment.
- 2. Equipment list identifying:
 - a. Model number of each unit.
 - b. Quantities of each type of device.
 - c. Unit costs (including labor).
- 3. Specifications compliance: A letter submitted with the bid responding to specification sub-sections individually, indicating exceptions, substitutions and alternates. The Contractor shall submit requests for substitutions (as well as all relevant technical data pertaining to the substituted equipment) to the specifier 10 days prior to the close of bid for evaluation and approval. For substitution requests refer to section 012500.

- B. Submittals/System Documentation:

- 1. Drawings: The Contractor shall submit shop drawings to provide "reasonable" details of proposed system components, layout, and wiring. The following is a list of required drawings:
 - a. Equipment location drawings indicating locations of all system components such as the control panel, the console keypads, detectors, audible and visible alarm annunciators, power supply boxes and accessories.
 - b. Riser diagrams indicating the system in a block diagram form. This diagram shall indicate the block interconnection of system components, the distribution of detectors and alarm annunciators by floor or area, the types of detectors and annunciators, zoning information, and number and type information.
 - c. Conduit and wiring drawings indicating conduit routing, junction boxes, splice locations, and types and counts of wiring in each conduit.
 - d. Typical color-coded wiring diagram for each type of device.
 - e. System point-to-point drawings indicating system component interconnection.

- C. Documentation: (At the time of system acceptance)
 - 1. "As-builts": Indicating actual installation details, including modifications to items listed in Section 1.3 paragraph B.
 - 2. Operation and Maintenance Manuals: Per manufacturer's guidelines.
- D. System Approvals:
 - 1. Standard product of one manufacturer. Manufacturer in business manufacturing similar projects for at least five (5) years.
 - 2. Approvals and listings U.L.
- E. Quality Assurance
 - 1. MTBF - Mean Time Between Failure
 - 2. FMECA - Failure Mode Effect and Criticality Analysis
 - 3. MTTR - Mean Time to Repair

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. New system complete with all devices, wiring, programming, power supplies and so forth to form a complete and fully functional system.

2.2 MATERIALS

- A. System Hardware Description:
 - 1. Security Control Panel: Bosch 9412
 - 2. System Accessories:
 - a. Motion Sensor – As required for installation location.
 - b. Door Switch
- B. Wiring: The Contractor shall provide cables consistent with the Manufacturer's recommendations. The following general guidelines shall be followed for wiring installation.
 - 1. Wiring shall be appropriate color-coded with permanent wire markers. Copper conductors shall be used.
 - 2. All junction boxes that are visible/accessible shall be painted blue unless in finished areas.
 - 3. ALL cables, where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway. (Check your local codes/authorities for variations or additional local requirements).
 - 4. Wire size for Initiating Device Circuits (IDC) shall not be smaller than 16 AWG stranded/14 solid, 14 AWG for signaling line circuits (SLC). Stranded wire must be bonded or shall have seven (7) strands max.
 - 5. IDC or SLC wires shall not be enclosed in conduit or raceways containing "AC" wires. Inside FDAC control panel, "AC" wires must be appropriately separated.
 - 6. Where EMI may interfere with the proper operation of the initiating circuits, twisted/shielded cable shall be used.

7. All cable shall be PLENUM rated or installed in conduit

PART 3 - EXECUTION

3.1 INSTALLATION (Based on)

- A. Applicable Requirements of Referenced Standards.
- B. System Installation Criteria per Manufacturer's Recommendations.
- C. Approved Submittals.
- D. Many door switches are installed in aluminum storefront. Fish flexible conduit in doorfront as it is installed to door head location. Install wires in flex. Coordinate all provisions with general contractor.

3.2 SUPERVISION

- A. Supervision of Sub-Trades.
- B. Coordination with Other Contractors for System-Related Work. (Electrical contractor, finish hardware contractor, Consultant and general contractor).
- C. Keeping Updated Construction Drawings.

3.3 PROGRAMMING

- A. Programming System Configuration Parameters (hardware and software-zone/circuit numbers, and communication parameters).
- B. Programming Operational Parameters (textual displays, telephone numbers, input/output event responses).
- C. Other System Programming Tasks Required by the Engineer. These additional programming requirements shall be submitted by the Engineer to the Contractor prior to system programming.

3.4 TESTING/VERIFICATION OF SYSTEM PERFORMANCE

- A. The Contractor shall perform a complete operational test of the system and verify that all system components comply with the performance criteria defined by the manufacture's specifications prior to the "Acceptance Testing".
- B. The Burglary Alarm System Certification Document, the Certificate of completion for a Central Station Signaling, the "as-builts" and the Manufacturer's instruction manual(s) shall be available at the time of acceptance testing. The Contractor shall notify the authorities having jurisdiction and pertinent personnel, prior to testing, that the system is under test.

- C. All system components shall be 100% tested. Additional testing procedures specified by the Manufacturer shall be implemented. Testing shall include:
1. Installation Testing: Test the security system for:
 - a. Stray voltages.
 - b. Ground faults.
 - c. Short circuit faults (conductor-to-conductor isolation & conductor to ground).
 2. System Testing: Test the panel monthly for:
 - a. Supervisory condition for all initiating devices.
 - b. Alarm condition for all initiating devices.
 - c. Primary and secondary power supply integrity.
 - d. Transmission and reception of all signals transmitted over telephone lines to the Central Station.
 3. Periodic Testing: Bi-monthly testing shall be performed and documented to test the proper functioning of the system.

END OF SECTION 281600

SECTION 282300 – VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Provide Video Surveillance System and associated cabling as specified herein and indicated on plans. System shall include cameras, servers, viewing clients, software, cabling and all other accessories required for a complete and fully functional system.

1.2 GENERAL PRODUCT REQUIREMENTS

- A. The software shall be of the video management system provider's official product line and designed for commercial/industrial use 24/7/365.
- B. The Hardware shall be Husky M50 standalone NVR with Milestone professional software pre loaded.
- C. The software shall be based upon standard components and proven technology using open and published protocols.
- D. The video management system provider shall be defined as the manufacturer of the video management software, and the party responsible for rigorous self-testing of the software prior to the release of the software.

1.3 QUALITY ASSURANCE

- A. The video management system provider shall offer thorough training to contractors in the service and installation of the provided software.
- B. All installation, configuration and setup of software as well as related work hereto shall be carried out by qualified technicians thoroughly trained by the video management system provider in the installation and service of the provided software.

1.4 GENERAL SYSTEM DESCRIPTION

- A. The specification establishes a basis of performance and quality for the system. Where specific manufacturers and models are listed it is acceptable to provide a similar and equal system by other manufacturers.
- B. The system shall be a fully distributed solution, designed for multi-site and multiple server installations requiring 24/7 surveillance with support for devices from different vendors.
- C. It shall be possible to connect up to 64 cameras or other devices for each recording server and for up to 5 recording servers to be connected to a single master recording server across multiple sites. The system shall support any combination of master and slave servers to provide flexibility and scalability in the overall system configuration.

- D. The video management system shall support Microsoft Vista Business/Enterprise/Ultimate, Windows 2003 Server, Windows XP Professional, Windows 7 Professional/Enterprise/Ultimate and Windows Server 2008. All as 32-bit or 64-bit (running as 32-bit) applications and with the latest patches and service packs installed. The system shall use DirectX and .NET.
- E. The following eight major components shall be included in the system:
 - 1. Surveillance system server, which shall consist of the following add-on applications/solutions or services:
 - a. Recording server (a service).
 - b. Management application.
 - c. Image server (a service).
 - d. Event server (a service).
 - e. Download manager.
 - f. Mobile viewing client server.
 - 2. Viewing client.
 - 3. Web viewing client.
 - 4. Standalone viewing client (for exported video recordings).
 - 5. Video-sharing application.
 - 6. Transactional data application.
 - 7. Graphical alarm management solution.
 - 8. Mobile viewing client.
- F. The system shall be able to incorporate a fully integrated video-sharing functionality that shall enable distributed viewing of any camera in the system, from any computer with the viewing client or video-sharing application installed.
- G. The system shall include support for a graphical alarm management solution. This solution shall support continuous monitoring of the operational status and event-triggered alarms from system servers, cameras and other external devices. The solution shall visualize the status of cameras and other inputs with graphical and interactive icons.
- H. The system shall include support for a transactional data application designed to integrate with Point of Sale (POS) or Automated Teller Machine (ATM) data and time-link video recordings with POS or ATM transactions.
- I. The system shall include a software development kit (SDK) which shall allow for the capability of integrating the system with third-party software. The SDK shall enable the user to:
 - 1. Retrieve live and recorded video in different ways:
 - a. In raw data format, either encoded or decoded, or
 - b. As a window to be resized and shown embedded in another application.
 - 2. Create plug-in components for the viewing client.
 - 3. Control the operation of video-sharing functionality.
 - 4. Retrieve alarm/event information.
 - 5. Integrate data sources for the transactional data application.
 - 6. For further information concerning SDK, see the 2.09

1.5 SOFTWARE DEVELOPMENT KIT (SDK) section.

- A. The system shall provide connectivity with third-party systems and devices using the OPC (Object-Linking and Embedding Process Control) Data Access set of communication standards. The supported third-party systems must include industrial automation and SCADA (Supervisory Control and Data Acquisition) systems. The system shall support the following commands and interfaces:
 - 1. Get configuration.
 - 2. Get server CPU load.
 - 3. Get camera status and frame rate.
 - 4. Get camera and global events.
 - 5. Set events.
 - 6. Set the video-sharing application's live view and playback.
- B. The system shall include a standalone viewing client that shall be able to show video exported from the viewing client. The standalone viewing client shall enable recipients of the video to browse and play back exported video without installing separate software on their computers.
- C. The system shall be designed to support each component on the same computer for efficiency in smaller systems or in a distributed architecture for large system deployments. Video management system core components must be installed on the same server.
- D. It shall be possible to install and run the system on virtualized Windows® servers.

PART 2 - PRODUCTS

2.1 LICENSING

- A. The video management system shall require licenses for its use. There shall be two different forms of licensing connected to the system with their own separate purposes.
 - 1. Base license code: the operator of the video management system shall be provided with a temporary license file that shall include a base license code for the video management system that shall allow for a trial period of 30 days. The temporary license file shall be used in the installation process and must be replaced by a permanent license file before the completion of the 30 day trial period.
 - 2. Device license key: every hardware device added to the video management system shall require a separate device license key that is unique to the hardware device in question.
 - a. A 30 day grace period shall be activated once cameras have been added to the video management system.
 - b. It shall be possible to activate all hardware devices in the system using one, single license file.
 - 1) If activation of the license file takes place after the 30 day grace period, cameras that are not activated shall become unavailable in the video management system. Activation of the license file shall restore activation of the cameras.
 - 2) The base license code must be registered before device license keys can be activated.
- B. Registration of the video management system shall be possible as online activation and offline activation of licenses via the management application.

1. Online activation shall be available via the management application for computers that have access to the internet. It shall be possible to specify the number of licenses wanted for each device.
2. Offline activation shall be available via the management application for computers that do not have access to the internet. It shall be possible export a license file to an external device, and then activate the license file on a different computer with internet access, by logging on to the website of the video management system provider from the computer with internet access.
 - a. The operator must enter a valid email address to which the license file can be sent.
 - b. It shall be possible to import the received license file in the management application after which the permanent license file shall be activated in the video management software.

2.2 SURVEILLANCE SYSTEM SERVER

- A. The surveillance system server shall consist of the following add-on applications or services:
 1. Recording server (a service).
 2. Management application.
 3. Image server (a service).
 4. Download manager.
 5. Mobile viewing client servers.
- B. The surveillance system server shall support a master/slave setup of the image servers (a service running on the surveillance system server) and, in this way, enable the operator to connect to all image servers in the system by connecting to only the master image server.
- C. The surveillance system server shall support the use of separate networks, VLANs or switches for connecting the cameras to the recording servers. The system shall provide physical network separation from the clients and facilitate the use of static IP addresses for the devices.
- D. The surveillance system server shall support H.264, MPEG-4 (both ASP and SP), and MJPEG compression formats for the video stream from all devices including analog cameras connected to encoders, DVRs, and IP cameras connected to the system. In addition, the system shall support the MxPEG video compression algorithm, which is unique to Mobotix. MxPEG encoding shall have the capability to maintain high image quality for megapixel cameras while dramatically decreasing bandwidth consumption.
- E. The surveillance system server shall be able to record the native camera frame rate and resolution (NTSC, PAL, HD or Megapixel), or as configured in the management application.
- F. The system shall support port forwarding, and shall enable clients from outside of a Network Address Translation (NAT) firewall to connect to recording servers without using a VPN.
- G. Each server shall be mapped to a specific port and this port shall be forwarded through the firewall to the recording server's internal IP address.

2.3 RECORDING SERVER

- A. Recording servers shall be able to record video feeds and communicate with cameras and other devices.

- B. The system shall support an unlimited number of recording servers. One or more recording servers shall be used in a system, depending on the number of cameras or the configuration of the physical system.
- C. The recording server shall support the use of pre- and post-recording on motion/event recording. Number of seconds for pre- and post-recording time periods shall be independently configurable.
- D. Each recording server shall have a default storage area – one or several folders - where the database content, primarily recordings from the connected cameras, shall be stored. Recordings from each connected cameras shall be stored in individual camera databases. The system shall allocate an unlimited amount of storage for each connected device.
- E. A administrator shall be able to enable archiving on a per camera basis and define the archiving drive for each camera.
- F. The recording server shall be able to use high performance iSCSI, SCSI, SAS, or SSD disk drives for recent recordings and use lower cost SATA drives for the RAID arrays for archived recordings. Use of online archiving shall ensure that data always is readily available. Viewing video from either the recent storage or the archive storage shall be transparent to the operator.
- G. The archiving shall happen transparently and shall enable operators of viewing client to access archive recordings without the need to restore the archived video to a local hard drive.
- H. System administrators shall be able to define storage areas for the specific camera databases and define new storage areas on the recording server, or on a connected network drive. The system shall support repair or archive of recordings in the event a connected network drive will become unavailable, so that no recordings will be lost.
- I. The surveillance system server shall save local databases a defined number of days or hours. The database retention settings must regulate how long recordings shall remain in a camera's database before the recordings are archived.
- J. The surveillance system server shall support archiving (an automatic transfer) of recordings from a camera's default database to another location on a time-schedule, without the need for user action, or initiation of the archiving process. Archiving shall support that the duration of the camera's recordings can exceed the camera's default database capacity. Archives shall be located on either the recording server computer or on a connected network drive. If the storage area on a network drive becomes unavailable for recording, the system shall be able to trigger actions such as automatic e-mails to defined personnel.
- K. The system shall support efficient creation and management of the recording server's archives.
- L. The recording server(s) shall have the ability to support multiple Network Interface Cards (NICs) and be able to support connection to the cameras, DVRs and encoder devices on a network separate from the viewing client.
- M. The recording server shall run as a service and must typically be installed on dedicated computer(s).
- N. The recording server operational status shall be displayed via an icon in the system tray. Right-clicking the recording server icon shall open the following status and control functionality:
 - 1. Status icon - recording server is running.
 - 2. Status icon - recording server is stopped.
 - 3. Control - stop recording.

4. Control - start recording.
 5. Control - view system status.
 6. Control - view recording and image server log files.
- O. The recording server shall continuously log server status messages that shall be possible to view by clicking a status icon in the system tray.
- P. Bandwidth management
1. The recording server shall offer the following options for managing bandwidth utilization (camera device dependent):
 - a. CODEC selection; MJPEG, MPEG-4, MxPEG, or H.264.
 - b. Resolution.
 - c. Frame rate.
 - d. Compression.
 - e. Bandwidth setting.
 - f. Fixed or variable bit rate setting.
 2. From the viewing client, operators shall have the possibility to have video images continually streamed or only updated on motion to conserve bandwidth between the viewing client and the recording server.

2.4 MANAGEMENT APPLICATION

- A. The management application shall provide a feature rich and intuitive interface for initial configuration and day to day administration of the system.
- B. The management application shall incorporate adaptable application behavior features whereby novice users shall be guided while expert operators shall be able to optimize the application for efficient use.
- C. The management application shall provide configuration of the system through both pre-defined wizards as well as directly through a tree-style advanced configuration method. Wizards shall support configuration of the following:
1. General
 - a. General recording and storage properties shall enable system administrators to edit certain properties for many cameras at one time using templates. In addition to those elements specified within the configure video and recording wizard, the system shall support configuration of the following properties:
 - 1) Configuration of keyboard shortcuts, which shall enable operators to toggle between viewing video from different cameras.
 - 2) Configuration of event-based recording, where the system administrator shall have the capability to specify both start and stop events.
 - 3) Enable manual recording that shall include configuration of default duration and maximum duration of manual recording initiated by authorized operators.
 - 4) Audio selection associated with specific cameras, shall include selection of default microphone and default speaker.
 - 5) Enable or disable audio recording for all cameras.
 - b. Storage information for the system and all drives/paths shall be displayed within the general recording and storage properties feature.

2. Camera-specific

- a. In addition to those properties described within the configure video and recording wizard, the adjust motion detection wizard, and the general properties above, the following shall be configurable within the camera-specific properties:
 - 1) Speedup control so that a camera's live and/or recording frame rate speeds up on motion or upon the activation of specified system events.
- b. Configuration of device-specific properties supported by the device's manufacturer.
 - 1) Configuration of events associated with the camera and device in question so that events can be associated with notifications in the viewing clients.
 - 2) Configuration of outputs associated with the specific camera in question.
 - 3) Setup of pan, tilt and zoom preset positions. The system shall support setup of preset positions on the server, imported from the camera, or stored on the camera.
 - 4) Configuration of pan, tilt and zoom patrolling. Patrolling features that shall be configured includes the following:
- c. Patrolling profiles that determine the sequence of the patrol.
- d. Preset positions to use in a patrolling profile.
- e. Wait and transition times for a patrolling profile.
- f. Pan, tilt and zoom scanning (continuous panning.)
- g. Pausing pan, tilt and zoom patrolling.
- h. Configuration of pan, tilt and zoom presets on event.

D. Events and output

- 1. The advanced configuration tree shall support configuration of events so that they can automatically trigger actions in the system, including activation of outputs.
- 2. The system shall provide for configuration of the following:
 - a. Ports and polling properties shall include:
 - 1) Alert and generic event port.
 - 2) SMTP event port.
 - 3) FTP event port.
 - 4) Polling interval.
 - b. Hardware input events.
 - c. Manual events, triggered by authorized users.
 - d. Generic events, shall support integration with third party systems such as access control and alarm monitoring systems. These events shall have the following configurable properties:
 - 1) Event name.
 - 2) Event port.
 - 3) Content elements, defining the specific text that activates the event.
 - 4) Assembly of content elements, defining the collection of content elements initiating an event.
 - 5) Event priority.
 - 6) Event protocol, which shall support selection of which type of event protocol, TCP or UDP is monitored.
 - 7) Event rule type, which shall make it possible to specify whether the event message expression is an exact match or match only part of a larger message.
 - 8) Send e-mail if event occurs.
 - 9) Attach image from camera.

- 10) Send SMS if event occurs.
 - e. Timer events, which shall occur a specified number of seconds or minutes after the event under which they are defined has occurred.
 - f. Hardware output configuration, including the following properties:
 - 1) Output name.
 - 2) Port to which output is connected.
 - 3) Amount of time for which output should be applied.
 - g. Configuration of hardware output on events so that outputs are activated upon initiation of specific events.
- E. Scheduling and archiving
- 1. The advanced configuration tree shall provide configuration of general and camera-specific properties.
 - 2. General configuration:
 - a. Advanced configuration of scheduling and archiving shall enable system administrators to configure schedules to control the following camera properties:
 - 1) Online/offline.
 - 2) Speedup.
 - 3) E-mail notification.
 - 4) SMS notification.
 - 5) PTZ patrolling.
 - b. The following scheduling options must be available for configuration:
 - 1) Start cameras on client requests: shall enable operators of viewing clients to force a camera to be online even if it is outside the camera's normal online schedule without triggering recording.
 - a) A start manual recording feature shall be available for operators given the rights to turn on recording.
 - 2) Default schedule profile for new cameras.
 - 3) Maximum delay between reconnect attempts.
 - c. The following archiving properties shall be configurable:
 - 1) Archiving time.
 - 2) Send e-mail on archive failure.
 - 3) Send SMS on archive failure.
 - 3. Camera-specific configuration:
 - a. The system shall provide a calendar function in which periods of minimum 5 minutes can be defined.
 - b. Clicking and dragging on any day within the week, shall select the time period and enable it for the appropriate schedule.
 - c. Schedules for the following must be available:
 - 1) Online period.
 - 2) Speedup.
 - 3) E-mail notification.
 - 4) SMS notification.
 - 5) PTZ patrolling.

- F. The system shall support configuration and use of video-sharing functionality. The video-sharing functionality shall be available for configuration in the management application which shall include a configuration tab and event tab:
1. Configuration tab shall provide status and shall support configuration of individual computer displays to be used as video-sharing recipients. The tab shall provide the following options:
 - a. A status window that shall list all video-sharing recipients in the system. The status window shall show the following properties for each video-sharing recipient in the system:
 - 1) User-defined name.
 - 2) IP address.
 - 3) IP port number.
 - 4) Password.
 - 5) Enable/disable status for shared video to be displayed in viewing clients defined as video-sharing recipients.
 - b. A user interface to add, clear, and update video-sharing functionality settings.
 2. An event tab shall support configuration of live video to be presented by video-sharing recipients upon selected predefined events.
 - a. The event tab shall make it easy to select events that trigger sharing of live video viewing on the video-sharing recipients.
 - b. The event tab configuration menu shall provide an easy to use interface to select which video feed/device that shall be displayed on the video-sharing recipient when a specific event happens.
- G. Logs
1. The system shall generate the following log files:
 - a. Management application.
 - b. Recording server service.
 - c. Image server service.
 - d. Image import service.
 - e. Event.
 - f. Audit
 - g. Standalone viewing client export.
 2. An advanced configuration tree shall enable system administrators to specify where the log files are saved.
 3. The system shall provide possibility for log integrity check, minimum once each 24 hours.
- H. The system shall support e-mail messaging with the following options:
1. Possibility to enable/disable e-mail while the recording server is running.
 2. Possibility to enable/disable e-mail from within the viewing client. This feature shall allow or restrict operators' access to send evidence files as an e-mail attachment.
 3. Setup e-mail account information:
 - a. Recipients.
 - b. Sender e-mail address.
 - c. Outgoing SMTP (Simple Mail Transport Protocol) server name.
 - d. Enable/disable e-mail server login.
 - 1) Username.

2) Password.

- e. Subject text.
- f. Message text.
- g. Enable/disable the attachment of an image in the e-mail.
- h. Minimum time between e-mail transmissions.
- i. Send a test e-mail using the current settings.

I. The system shall support SMS messaging with the following options:

- 1. Possibility to enable/disable SMS messaging.
- 2. Set the GSM modem communication port.
- 3. Set the SIM card PIN code.
- 4. Set the SIM card PUK code.
- 5. Set the SMS central phone number.
- 6. Set the recipient phone number.
- 7. Set a default message.
- 8. Set the minimum time between SMS message transmissions.
- 9. Send a test SMS message using the current settings.

J. Graphical alarm management

- 1. For further information concerning graphical alarm management, see the 2.18
- 2. 2.17

2.5 GRAPHICAL ALARM MANAGEMENT SOLUTION section.

A. Server access

- 1. An advanced configuration tree shall provide configuration of the following properties:
 - a. Server name.
 - b. Local port.
 - c. Enable/disable internet access.
 - d. Maximum number of clients.
- 2. The system shall enable system administrators to specify IP address ranges that the system shall be able to recognize as coming from the local network.
- 3. The system server shall be able to support multiple language/character sets.

B. Master/slave

- 1. The system shall support any server to function as a master server. Each master server shall be able to be assigned a series of slave servers in the management application. When selecting a master server from the viewing clients, it shall be possible to view and manage all cameras/devices connected to each master, plus all cameras/devices assigned to each slave. The settings for the master/slave image server setup shall be:
 - a. Select a specific server as a master server.
- 2. The user interface shall enable system administrators to add slave servers. Each slave server shall be added to a list of assigned slaves for each master.
- 3. The user interface shall enable system administrators to delete a specific slave server from a list of slaves available to a master.
- 4. It shall be possible to update the connection status between master and slave servers.

- a. A status dialog shall inform operators of the status of the selected slave server.
- b. It shall be possible to check the connection status of multiple slave servers at the same time.

C. Users

- 1. The advanced configuration tree shall support configuration of the following properties in addition to those specified in the configure user access wizard:
 - a. General access settings where system administrators shall have the ability to grant or restrict access to the following system functions:
 - 1) Live view.
 - 2) Playback.
 - 3) Setup.
 - 4) Create/edit shared views.
 - 5) Create/edit private views.
 - b. Camera access settings
 - 1) System administrators shall be able to grant or deny access to each camera in the system.
 - 2) The system administrator shall be able to grant or restrict the following access rights parameters:
 - a) PTZ control.
 - b) PTZ preset positions.
 - c) Output.
 - d) Events.
 - e) Incoming audio.
 - f) Outgoing audio.
 - g) Manual recording.
 - h) AVI/MJPEG export.
 - i) Database export.
 - j) Sequences.
 - k) Fast search feature.
 - l) Recorded audio.
- 2. The system shall support configuration of user groups to simplify management of multiple user accounts with similar properties.

- D. An advanced configuration tree shall provide the ability to monitor, start, stop and restart system services.

E. Alarms

- 1. For more information about alarms, see the 2.08
- 2. ALARM section.

2.6 ALARMS

- A. The alarms feature shall use functionality handled by the event server. It shall provide central overview, control and scalability of alarms in any number of installations of the video management system software in an organization.
- B. It shall be possible to define the following general settings for alarms:

1. The number of days for which to keep closed alarms (alarms closed, ignored or rejected). There shall be a default value that shall indicate the number of days to keep the alarms, which by default shall be 1. It shall be possible to define from 1 to 99,999 days. The value 0 shall indicate that alarms are to be kept indefinitely.
 2. The number of days to keep all other alarms (alarms not closed, ignored or rejected). There shall be a default value that shall indicate the number of days to keep the alarms, which by default shall be 30 days. It shall be possible to define from 1 to 99,999 days. The value 0 shall indicate that alarms are to be kept indefinitely.
 3. The number of days to keep alarm logs for. There shall be a default value that shall indicate the days to keep the alarms, which by default shall be 30 days. It shall be possible to define from 1 to 99,999 days. The value 0 shall indicate that alarms are to be kept indefinitely.
 4. To save a separate log of server communication in addition to the regular log.
- C. The alarms feature shall include an alarms configuration that shall allow for:
1. Enabling of the individual alarms.
 2. Naming the alarm. The name shall appear whenever the alarm is listed.
 3. Typing in an optional description text, for example a description of the procedure to undertake in the event of an alarm being triggered.
 4. Specifying a triggering event. This shall let operators select the event which should be in use when the alarm is triggered. The list shall include both system-related events and plug-ins.
 5. Selecting the camera or other device, including plug-in defined sources, from which the event should originate in order to trigger the alarm.
 6. Choosing which type of triggering function should be active. An alarm activation option shall allow the operator to choose between two different ways of alarm activation:
 - a. Time profile-based: the operator shall be able to define periods of time when the alarm should be enabled for triggering.
 - b. Event-based: the operator shall be able to select which events should start and stop the alarm. It shall be possible to select the following type of events:
 - c. Hardware-events defined on cameras.
 - d. Video servers and in- and output.
 - e. Global/manual event definitions.
 7. Selecting cameras to be included in the alarm definition even if they are not themselves triggering the alarm, for example if you have selected an external event message (for example a door being opened) as the source of the alarm.
 8. Selecting a priority for the alarm. It shall be possible to choose between high, medium or low.
 9. Defining an event to be triggered by the alarm in the viewing client.
 10. Selecting if the alarm should be closed automatically upon a particular event.
- D. Third-party developed applications shall be able to integrate with the video management system to access a variety of program functionalities:
1. Video and audio functionality.
 - a. Retrieve and display live and recorded video.
 - b. Retrieve and play live and recorded audio.
 - c. Retrieve and display single frame JPEG images.
 - d. Video and audio export in AVI and database format.
 - e. Place overlay information on live and recorded video in component-based implementation and in plug-ins for the viewing client.
 2. Event and alarms
 - a. Trigger internal (system-related) and external (integrated) events and alarms.

- b. Retrieve a list of triggered alarms.
 3. Security
 - a. Manage user rights on plug-in functionality.
 - b. A framework for system access and security token handling.
 4. Configuration
 - a. Retrieve video management system configuration, including camera, user and alarm information.
 - b. Enable third party applications to save and retrieve their own configuration.
 5. Control
 - a. Send PTZ commands to cameras.
 - b. Retrieve PTZ position from absolute PTZ cameras.
 - c. Send a start or stop recording event from a specific event.
 - d. Activate external output.
 - e. Control video wall application functionality.
 - f. Send camera to a matrix monitor.
 - g. Send commands to third-party-developed plug-ins.
 6. System status
 - a. Receive all status messages from the video management system, including server disk, CPU usage, and triggered events.
- E. Applications developed with the SDK shall integrate with both the management application and the viewing client.
 1. It shall be possible to develop plug-ins for the viewing client, the management application and the event server.
 2. It shall be possible to run custom-made applications and configuration in the management application.
 3. An event server plug-in shall make it possible to develop functionalities that shall run as a plug-in in the event server service in the management application. This shall allow event-based functionality to be executed without needing to have a user interface open.
 4. It shall be possible to combine and integrate the functionality of one custom-made plug-in with functionality of another custom-made plug-in.
 5. A development framework shall be available that shall facilitate the integration of third-party custom made applications. The framework shall include:
 - a. Documentation with application and code samples.
 - b. A tool box with open access to the video management system provider's libraries and code components for:
 - 1) System logon.
 - 2) Video decoding and rendering.
 - 3) Configuration distribution.
 - 4) Authorization verification.
 - 5) Microsoft Visual Studio® project templates.
 - 6) A developmental tool for, for example, traces and program logs.
- F. The SDK feature shall support integration of video content analytics for event reporting.
 1. An analytics event plug-in for the event server shall be available for free download on the website of the video management system provider.
 2. The operators shall be able to run a web viewing client (without installation).

3. The operators shall be able to install add-on applications from the welcome page.
- G. The download manager configuration tool shall support configuration of what the download manager welcome page will present to the operators. The configuration tool shall support selection and de-selection of various applications, as well as language packs.
- H. A playback tab shall enable operators to select the views for playback of recorded video. Views shall be defined in the setup tab.
- I. The system shall enable live or playback video for a selected camera to switch to full image quality when the camera's view is maximized, unless a 'keep when maximized' function is selected and the stored camera settings are not set to full image quality. If the 'keep when maximized' function is selected, the defined quality settings for the selected camera shall be used.
- J. The playback tab shall display sequences with motion for the selected camera in a drop down menu. Each sequence shall be represented by a line with the date, start time and duration. A drop down preview screen shall enable operators to view the recorded sequence.
- K. The playback tab shall contain a time navigation pane, which shall enable video sequences for the displayed cameras to be reviewed simultaneously.
 1. The window shall provide controls for:
 - a. First/last image.
 - b. Next/previous sequence.
 - c. Next/previous image for selected camera.
 - d. Playback forward/reverse.
 - e. Playback speed.
 - f. Skip gaps during playback.
 - g. Search by time/date.
- L. The playback tab shall contain an intelligent search feature, which shall allow an area of interest in an image to be searched for motion in a defined time interval. Search parameters shall include sensitivity and interval. A grid feature shall enable that only specific regions of interest are searched.
- M. The playback tab shall contain a print feature, which shall enable a surveillance report to be printed with the image from the selected camera including specific information such as camera name, capture time, report print time, operator name and notes (if any). The surveillance report must be printed to any network connected printer.
- N. The playback tab shall contain an export feature, which shall enable selection of start and stop times for exporting video from a camera/device source. Possible file formats for the export shall be AVI, MJPEG, or a native database format.
 1. The operator shall be able to select the format for the export. Any codec installed on the system shall be selectable. In addition to export format, time stamp, frame rate, and digital zoom export shall be selectable. Video clip must be exported to desktop, or to a specific file path. The audio input from a microphone connected to a camera/device associated with the video being exported shall automatically be included in the AVI export.
 2. A native database export function shall support export of up to 16 cameras and shall provide options for including audio associated with the video, security options including compressing and/or encrypting exported database and destination options including desktop, or a specific file path. It shall also include option for a standalone viewing client to be attached to the exported file.

3. A playback tab shall contain PTZ control features, which shall enable digital zoom in recorded video. Using the PTZ control pane's navigation buttons, it shall be possible to use PTZ in the view from a selected fisheye camera.
- O. The playback tab shall via a sequence explorer feature pane be able to list thumbnail images representing recorded sequences from an individual camera, all cameras or a subset of cameras in a view. The sequence explorer shall be launched in a floating window.
1. The floating window shall make it possible to change between motion, time and event thumbnails.
 2. The floating window shall have controls for moving forward and backwards in time.
 3. When clicking one of the various thumbnails, a preview video of the recorded video shall be displayed.
- P. The playback tab shall contain a timeline browser displaying a time line for each camera to represent recorded video sequences. The sequences shall be color coded to indicate motion detection sequences. For example, a red band shall indicate that the video is recorded because of detected motion, or a green band shall indicate that the recorded video is without motion, or is pre- and post-alarm video. The time line band for the camera selected in the view shall be highlighted in the display.
- Q. The system shall enable operators to program numerical keyboard shortcuts for camera views. The shortcut number shall be displayed with the view description in the live and playback tabs. The shortcut shall enable operators to change views with 2 to 3 keyboard entries.
- R. A setup tab shall contain a pane that shall enable the operator to configure the following properties:
1. An image quality setting that shall make it possible to select between: full, super high (for Megapixel cameras), high, medium and low resolution.
 2. A keep image quality when maximized setting that, upon maximizing a specific camera image in a full view window pane, shall allow a user to:
 - a. Use the selected image quality settings for the specified camera,
 - b. Use the maximum image quality available from the camera device regardless of the image quality settings for the device in the system.
 3. A frame rate setting that shall make it possible to select between: unlimited, medium and low frame rate.
 4. A maintain image aspect ratio setting that shall enable original image aspect ratio to be maintained in the display or enable the image to be scaled to fit the display.
 5. An update image on motion setting that shall enable bandwidth from the recording server to be conserved by only updating the image display on motion.
 6. A sound on motion detection setting that shall enable an audible alert to be generated when motion is detected in the camera image to alert operators.
 7. A sound on event setting that shall enable an audible alert to be generated upon an event to alert operators.
- S. The viewing client application shall be able to run on the following operating system setup:
1. Microsoft Vista Business/Enterprise/Ultimate, Windows 2003 server, Windows XP Professional, Windows 7 Professional/Enterprise/Ultimate and Windows Server 2008. All as 32-bit or 64-bit applications.

2.7 MOBILE VIEWING CLIENT

- A. It shall be possible to access and view cameras and views on a smartphone or a tablet (a mobile device).
- B. Access to cameras and views on a mobile device shall be established through three components:
 - 1. A mobile server that shall be able to run as a dedicated server or on a server running a video management system.
 - 2. A mobile plug-in that shall integrate with the video management system to provide the necessary configuration for the mobile server to integrate with the relevant video management system.
 - 3. A mobile client application that shall connect to the cameras and views in the video management system.
- C. The mobile device shall connect to the same network as the machine running the mobile server.
- D. Mobile server functionality:
 - 1. The installer for the mobile server shall be available on the website of the video management system provider.
 - 2. It shall be possible to configure the following elements for the mobile server in the management application/client:
 - a. Add a mobile server
 - b. Edit a mobile server
 - c. Rename a mobile server
 - d. Delete a mobile server
 - e. View server status, which shall include server status field that shall show:
 - 3. It shall be possible to fill in the following properties for the mobile server in the management application/client:
 - a. The name of the mobile server
 - b. Description of the mobile server
 - c. IP address, which shall be unique for the mobile server
 - d. Port number (default port 8081)
 - e. The default time frame for how often the mobile client must indicate to the mobile server that it is up and running.
 - f. Login method
 - 1) Automatic
 - 2) Windows only
 - 3) Basic only
 - g. Enable or disable viewing of an all cameras view.
 - h. Location of log file
 - i. Number of days log files are saved (default value shall be three days)
 - j. Default level of CPU usage
 - k. Default internal bandwidth usage
 - l. Default external bandwidth usage
 - m. Default time frame (30 seconds) for checking warning levels
- E. Mobile plug-in functionality:

1. The installer for the mobile plug-in shall be available on the website of the video management system provider.

F. Mobile client application functionality:

1. It shall be possible to download and install the mobile client application to a mobile device.
2. The mobile client application shall be available for free download on Google Play (former Android Market) or App Store.
3. The mobile client application shall work with smartphones or tablets with Android 2.2+, or iOS5+ or newer installed.
4. The mobile client application shall be able to log into the video management system through the mobile server functionality.
 - a. A correct login to the mobile server functionality shall enable the distribution of video streams from relevant recording servers to the mobile client.
 - b. It shall not be required to access the internet in order to establish the setup between the mobile client and the mobile server functionality.
 - c. It shall be possible to add as many mobile servers as required as long as the user has log-in credentials for these servers.
 - d. The mobile client shall use cameras and views already set up in the video management system.
 - 1) An all-cameras view shall be available for mobile client users that do not have any views set up in the management client/application.
5. The mobile client application shall include the following tabs:
 - a. A server tab, displaying the available server and letting users select which server to connect to.
 - b. A views tab, displaying displays and previews of available views.
 - 1) It shall be possible to choose between live and recorded video streams.
 - c. A setting tab, displaying user settings and allowing the user to edit to edit relevant settings.
6. Pressing the mobile device's menu button shall display a context sensitive menu that shall include the following items, depending on where in the mobile client application the user is:
 - a. Cancel, which shall cancel filter settings on views.
 - b. Edit, which shall edit the server settings of the selected server.
 - c. Exit, which shall exit full screen
 - d. Filter, which shall enable filtering on views.
 - 1) All views shall be selected by default.
 - 2) It shall be possible to clear views that are not needed.
 - e. Go to time, which shall open a menu that shall let the user select to view at a specific time in the past.
 - f. Help, which shall give access to the mobile client application's online help.
 - g. Home, which shall send the user to the list of views in the views tab.
 - h. Live, which shall exit playback mode on a selected camera and enter live mode.
 - i. New, which shall add and configure a new server.
 - j. Hide/show live picture-in-picture, which shall turn on/off a small picture-in-picture in live mode.
 - k. Playback, which shall switch from live to playback mode on a selected camera in playback mode.
 - l. Playback speed, which shall open a menu with a selection of playback speeds on a selected camera in playback mode.

- m. Presets, which shall open a menu with selection of presets for PTZ-cameras on a selected cameras.
 - n. PTZ, which shall enable a number of PTZ icons on the screen which shall allow you to pan, tilt and zoom in on the current image.
 - o. Save, which shall save your filtered view(s).
 - p. Snapshot, which shall take a snapshot of the current frame and save it automatically to an SD card.
7. The servers tab shall allow a user to tap a server to connect to this server and to access the server's context menu.
- a. The context menu for the servers tab shall contain the following settings:
 - 1) Disconnect a server
 - 2) Connect to a server
 - 3) Edit server settings for the server
 - 4) Delete the server from the mobile client application
 - b. It shall be possible to fill in the following details in the server context menu:
 - 1) Name, where it shall be possible to enter or edit the name of the server.
 - 2) Address, where it shall be possible to enter or edit the IP address of the computer where the server is running.
 - 3) Port number, where it shall be possible to edit the port number the mobile client application uses to communicate with the server. The default port number shall be 8081.
 - 4) Description, where it shall be possible to enter or edit a description for the server.
 - 5) User name, where it shall be possible to enter a user name.
 - 6) Password, where it shall be possible to enter a password.
 - 7) Save credentials, where it shall be possible to save user name and passwords for future usage.
 - 8) Automatic login, where it shall be possible to select that you want to log in automatically.
8. The views tab shall list the available views in a surveillance setup, as well as the type of view (private, shared, cameras), name and number of cameras.
9. The view tab menu shall contain the following settings:
- a. Filter
 - b. Help
 - c. Filter views, which shall make it possible to remove any views not needed.
 - d. Open a view in grid view
 - e. A filter menu, where it shall be possible to select save or cancel
 - f. The context menu for the views tab shall contain the following settings:
 - 1) Save
 - 2) Cancel
10. The settings tab shall allow a user to view and/or edit the following settings:
- a. Client version, which shall show the version number of the mobile client application installed on a smartphone/tablet.
 - b. Stay awake, which shall show whether sleep mode is disabled during video streaming or not (both in live and recording mode).
 - c. Frames per second, which shall set a frames per second value (between 1 and 30) for transfer of video from the mobile server to the mobile device.
 - d. Optimize bandwidth, which shall allow a user to reduce the quality of the images sent to the mobile client to preserve bandwidth.

- e. Auto-hide playback controls, which shall hide icons in the playback navigation bar automatically after a while. Tapping the screen shall make the playback controls reappear.
 - f. Auto-hide PTZ controls, which shall hide icons in the playback navigation bar automatically after a while. Tapping the screen shall make the PTZ controls reappear.
 - 11. Opening a view in grid view shall display all relevant cameras in a grid.
 - a. All cameras shall contain a red icon that shall indicate motion on the relevant camera when motion is detected.
 - b. All cameras shall contain a green icon that shall indicate that video is being recorded every time a new image is received from the camera.
 - 12. It shall be able to view a camera in full screen mode and adjust the image in the following ways:
 - a. Use PTZ on PTZ cameras
 - b. Zoom in and out (digital zoom) by pinching the screen
 - c. Switch between image fitting to screen and image cropped by tapping
 - d. View a camera in playback mode
 - 13. Playback mode shall include a navigation bar that shall help users navigate recorded video. The navigator bar shall include:
 - a. Buttons always available:
 - 1) A time-specification button
 - 2) A set playback speed button
 - b. Buttons available when playback is stopped:
 - 1) A view previous image button
 - 2) A forward playback button
 - 3) A backwards playback button
 - c. Buttons available when playback is running:
 - 1) A pause playback button
 - 2) A move to the first image in the next sequence-button
 - 3) A move to the first image in the previous sequence-button
 - 14. It shall be possible to view picture-in-picture in live mode.
- G. A default demo server shall be available in the mobile client application for users to test the mobile client application without having a video management system setup.
- 1. The demo server shall show random demo content, and it shall not be possible to edit or delete any views, cameras or settings of the demo server.

2.8 WEB VIEWING CLIENT

- A. The web viewing client shall offer live viewing of up to 16 cameras and include PTZ control with joystick and event/output activation. Its playback function shall give operators concurrent playback of up to 9 recorded videos with date, sequence or time searching.
- B. Support for shared and private server-based views with a layout of up to 4x4 shall be available. Any of these views shall have the ability to contain a combination of cameras, images, and HTML page view items.

- C. The web viewing client shall support Basic User Authentication logon using the image server account database which requires user name and password credentials.
- D. The web viewing client shall support the following languages: American English, Simplified Chinese, Danish, German, French, Italian, Japanese, Spanish and Swedish.

2.9 STANDALONE VIEWING CLIENT

- A. The standalone viewing client shall make it possible to view exported recorded video database files as well as other exported sources:
 - 1. Audio
 - 2. HTML content
 - 3. Images
 - 4. Analytics sources
- B. The standalone viewing client shall run from an .exe file, and no installation of software shall be required in order to view exported sources.
- C. The standalone viewing client shall share the interface and functionalities of the viewing client and shall be able to run new features developed for the viewing client.
- D. The standalone viewing client shall facilitate instant playback of exported material when the program is executed.
- E. A project functionality for investigation projects shall exist and allow for:
 - 1. Import of multiple exported sources that can be added to an existing project.
 - 2. Offline creation of new projects.
 - 3. Common tampering and password protection for the exported sources.
 - 4. It shall be possible to export 360° panomorph video recordings for cameras that support this technology for viewing in the standalone viewing client.
 - 5. It shall be possible to export video containing privacy masks, and the privacy mask shall cover the same area as defined in the management application in the standalone viewing client.
 - 6. It shall be possible to define a default export path handled by the surveillance system server. It shall be possible to allow operators to define their own export path in the viewing client by changing settings in the management application.
 - 7. The standalone viewing client shall be available in the following languages: American English, Arabic, Bulgarian, Simplified Chinese, Traditional Chinese, Czech, Danish, Dutch, Finnish, French, German, Hebrew, Hindi, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese (Brazilian), Russian, Spanish, Slovak, Swedish and Turkish.

2.10 CAMERAS

- A. Provide Megapixel IP cameras with streaming video technology. Manufacturer shall be ACTi. Provide quantity as per plans. Provide types per locations indicated on plans using suitable type for each location.
- B. Cameras shall be as follows:
 - 1. ACTi Model #E64. 1 megapixel indoor camera.
 - 2. ACTi Model #E65. 3 megapixel indoor camera.

3. ACTi Model #KCM-3911. 4 megapixel indoor camera.
4. ACTi Model #E77. 10 megapixel outdoor camera.
5. ACTi Model #E83. 5 megapixel outdoor camera.
6. ACTi Model #E86. 3 megapixel outdoor camera.

PART 3 - EXECUTION

- A. The contractor shall carefully follow the instructions in the documentation provided by the video management system provider to ensure that all steps have been taken to provide a reliable, easy-to-operate system.
- B. All equipment shall be tested and configured in accordance with instructions provided by the video management system provider prior to installation.
- C. Training: Provide 4 hours training to Owner's staff on usage of system.

END OF SECTION 282300

SECTION 283111 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Provide fully addressable voice fire alarm panel. All devices shall be new. Provide all equipment, programming and interface to make complete working system.
- B. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
- C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Remote Station Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
 - 1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 60 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.
- D. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
- F. Underwriters Laboratories Inc. (UL) - USA:
 - 1. No. 38 Manually Actuated Signaling Boxes
 - 2. No. 50 Cabinets and Boxes No. 864 Control
 - 3. Units for Fire Protective Signaling Systems
 - 4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
 - 5. No. 268A Smoke Detectors for Duct Applications
 - 6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
 - 7. No. 464 Audible Signaling Appliances
 - 8. No. 521 Heat Detectors for Fire Protective Signaling Systems
 - 9. No. 1971 Visual Notification Appliances
- G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.2 SCOPE:

- A. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. All circuits shall be power-limited, per 1995 UL864 requirements.
5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

C. Basic System Functional Operation:

1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
2. The system alarm LED on the FACP shall flash.
3. A local piezo electric signal in the control panel shall sound.
4. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
5. Printing from the control panel and history recording shall log the information associated each new fire alarm, along with time and date of occurrence.
6. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm

1.3 SUBMITTALS

A. General:

1. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications

1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
3. Provide electronic copy of all programming to the engineer to allow for reprogramming of system.

1.4 GUARANTY:

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5 MAINTENANCE:

- A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
 2. Each circuit in the fire alarm system shall be tested semiannually.
 3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
- B. National Fire Protection Association (NFPA) - USA:
 1. No. 13 Sprinkler Systems
 2. No. 70 National Electric Code (NEC)
 3. No. 72 National Fire Alarm Code
 4. No. 101 Life Safety Code

- C. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- D. Local and State Building Codes.
- E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
 - 1. UL Underwriters Laboratories Inc
 - 2. ULC Underwriters Laboratories Canada
 - 3. FM Factory Mutual
 - 4. MEA Material Equipment Acceptance (NYC)
 - 5. CSFM California State Fire Marshal

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- D. All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

2.2 CONDUIT AND WIRE:

- A. Conduit:
 - 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. All fire alarm wire will be installed in EMT conduit or surface metal raceway. No open wire or mc cable allowed on project.
 - 2. All wiring shall be installed in conduit or metallic raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.
7. All fire alarm system wiring shall be new. Except where connecting to existing fire alarm loops.
8. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
9. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
10. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
11. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. For new systems, shielded wire shall not be required.
12. All field wiring shall be electrically supervised for open circuit and ground fault.
13. The fire alarm control panel shall be capable of T-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., are not acceptable.

B. Terminal Boxes, Junction Boxes and Cabinets:

C. All boxes and cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to building ground through the equipment ground conductor. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

2.3 MAIN FIRE ALARM CONTROL PANEL:

A. The FACP shall be a Fire-Lite Model MS-9600LS or approved equal and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:

- a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
 - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Silence Switch:
 - a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch:
 - a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch:
 - a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
5. Lamp Test:
 - a. The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. System Capacity and General Operation

1. The control panel shall provide, or be capable of, expansion to 636 intelligent/addressable devices.
2. The control panel shall include Form-C Alarm, Trouble and Supervisory relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include programmable Notification Appliance Circuits (NACs) capable of being wired as Class B (NFPA Style Y) or Class A (NFPA Style Z).
3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, a standard PS2-style PC keyboard or from a computer running upload/download software.
5. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or REQUIRE a laptop personal computer are not considered suitable substitutes.
6. The FACP shall provide the following features:

- a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - b. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
 - c. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
 - d. The ability to display or print system reports.
 - e. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
 - f. Positive Alarm Sequence (PAS presignal), meeting NFPA 72 3-8.3 requirements.
 - g. Rapid manual station reporting.
 - h. Non-alarm points for general (non-fire) control.
 - i. Periodic detector test, conducted automatically by the software.
 - j. Walk test, with a check for two detectors set to same address.
7. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules.

D. Central Microprocessor

1. The microprocessor shall be a high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.

E. Local Keyboard Interface

1. In addition to an integral keypad, the fire alarm control panel will accept a standard PS2-style keyboard for programming, testing, and control of the system. The keyboard will be able to execute the system functions ACKNOWLEDGE, SIGNALS SILENCED, DRILL and RESET.

F. Display

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, MAINTENANCE, ALARM SILENCED, DISABLED, BATTERY, and GROUND conditions.
4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

G. Signaling Line Circuits (SLC)

1. The system shall include two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) addressable pull stations, addressable beam detectors, and 159 intelligent modules (monitor or control) for a system capacity of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
3. The detector software shall meet NFPA 72, Chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.

H. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the EIA-232 communications standard.
2. One EIA-232 interface shall be used to connect a UL-Listed 80-column printer. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60Hz.

I. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected and painted red using powder coat techniques in the manufacturer's standard finish.
2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall provide for the viewing of all indicators.
4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure the panel to the enclosure back box.

J. Power Supply:

1. The main power supply for the fire alarm control panel shall provide 7.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral

- battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
4. The main power supply shall continuously monitor all field wires for earth ground conditions.
 5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP
- K. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances.
1. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 18.0 amp hour batteries.
 2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Four NAC outputs, wired NFPA Style Y or Z, shall be available for connection to the Notification devices.
 3. The FCPS shall optionally provide synchronization to all connected strobes or horn strobe combinations when System Sensor, Wheelock, or Gentex devices are installed.
 4. The FCPS shall function as a sync follower as well as a sync generator.
 5. The FCPS shall include a surface mount backbox.
 6. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.
 7. The FCPS shall provide 24 VDC regulated and power-limited circuitry per 1995 UL standards.
- L. Specific System Operations
1. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.
 2. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
 3. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status
 - b. Device type
 - c. Custom device label
 - d. Device zone assignments
 4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
 5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 1000 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety.
 6. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
 7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
 8. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible

indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

9. Software Zones: The FACP shall provide 99 software zones.
10. The fire alarm control panel shall include Silent and Audible Walk Test functions - Silent and Audible. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
 - a. The Silent Walk Test will not sound NACs but will store the walk test information in History for later viewing.
 - b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 4 seconds.
 - c. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
 - d. Walk test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for walk test shall continue to provide fire protection and if an alarm is detected, will exit walk test and activate all programmed alarm functions.
 - e. All devices tested in walk test shall be recorded in the history buffer.
11. Waterflow Operation
 - a. An alarm from a waterflow detection device shall activate the appropriate alarm message on the 80-character display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.
12. Supervisory Operation
 - a. An alarm from a supervisory device shall cause the appropriate indication on the 80-character display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
13. Signal Silence Operation
 - a. The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.
14. Non-Alarm Input Operation
 - a. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.
15. Combo Zone
 - a. A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.4 SYSTEM COMPONENTS:

A. Programmable Electronic Speakers:

1. Electronic speakers shall operate on 24 VDC nominal.
2. Electronic speakers shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as show on plans.

- B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
1. The maximum pulse duration shall be 2/10 of one second.
 2. Strobe intensity shall meet the requirements of UL 1971.
 3. The flash rate shall meet the requirements of UL 1971.
- C. Audible/Visual Combination Devices:
1. Shall meet the applicable requirements of Section A listed above for audibility.
 2. Shall meet the requirements of Section B listed above for visibility.
- D. Manual Fire Alarm Stations
1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
 2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
 3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
 4. Manual stations shall be constructed of sturdy metal construction, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.
- E. Waterflow Indicator:
1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
 2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
 3. All waterflow switches shall come from a single manufacturer and series.
 4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
 5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.
- F. Sprinkler and Standpipe Valve Supervisory Switches:
1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
 2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
 3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
 4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4-inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
 5. The switch housing shall be finished in red baked enamel.
 6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
 7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

- G. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.
- H. Digital Alarm Communicator Transmitter (DACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed Central Station.
 - 1. The DACT shall be compact in size, and shall plug into the fire alarm control printed circuit board within the control cabinet. Systems that utilize relay contact closures are not acceptable.
 - 2. The DACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
 - 3. The DACT shall be completely field programmable via the fire alarm control panel keypad or via downloaded programming information via a PC.
 - 4. The DACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
 - 5. Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status
 - c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault
 - e. System Off Normal
 - f. 12 and 24-Hour Test Signal
 - g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
 - 6. The DACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 640 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
- I. Field Wiring Terminal Blocks
 - 1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks which are permanently fixed are not acceptable.
- J. Addressable Devices - General
 - 1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
 - 2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
 - 3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
 - 4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
6. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
8. Detectors shall provide address-setting means using decimal switches.

K. Addressable Pull Box (manual station)

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual pull stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

L. Intelligent Multi-Sensing Detector (Smoke detector)

1. The intelligent detector shall be an addressable device which is capable of detecting multiple threats by employing photoelectric and thermal technologies in a single unit. This detector shall utilize advanced electronics which react to slow smoldering fires (photoelectric) and heat (thermal) all within a single sensing device.
2. The multi-detector shall include two bicolor LEDs for 360-degree viewing.
3. Automatically adjusts sensitivity levels without the need for operator intervention or programming. Sensitivity increases with heat.

M. Intelligent Thermal Detectors (Heat detector)

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

N. Intelligent Duct Smoke Detector

1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

O. Addressable Monitor Module for Dry Contact Devices

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.

3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

P. Two-Wire Detector Monitoring

1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
4. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount backbox.

Q. Addressable Control Relay Module

1. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
4. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

R. 6 Output Addressable Control Relay Module

1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
2. Using rotary address switches, the first module shall be addressed from 01 to 154 while the remaining modules shall be automatically assigned to the next five higher addresses. Note: binary dipswitches for setting address are not acceptable.
3. Provision shall be included for disabling a maximum of three unused modules
4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally open or normally closed operation.
5. The module shall allow an addressable control panel to switch these contacts on command.
6. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG wire.
7. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.

S. Six-Zone Interface Module

1. A six-zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.
2. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.
3. The first address on the interface module shall be addressed from 01 to 154 while the remaining modules are automatically assigned to the next five higher addresses.
4. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.
5. Provision shall be included for disabling a maximum of two unused addresses of the six available.
6. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.
7. The six zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.
8. Removable plug-in terminals shall be provided capable of accepting from 18 AWG up to 12 AWG wire.

T. Multiple Two-Wire Detector Monitoring

1. A single multi input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The first address on the 10 input boards shall be set from 01 to 150 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.
4. Provision shall be included for disabling a maximum of two unused addresses.
5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
6. The IDC zone may be wired for Class A or B (Style D or Style B) operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.

U. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.5 BATTERIES:

- A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time 60 hours followed by 5 minutes of alarm.
- B. batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST:

- A. The service of a competent, NICET level II technician shall be provided to technically supervise and participate during all the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.
- B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- D. Verify activation of all waterflow switches.
- E. Open initiating device circuits and verify that the trouble signal actuates.
- F. Open and short signaling line circuits and verify that the trouble signal actuates.
- G. Open and short notification appliance circuits and verify that trouble signal actuates.
- H. Ground all circuits and verify response of trouble signals.

- I. Check presence and audibility of tone at all alarm notification devices.
- J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION:

- A. At the final inspection, at a minimum a NICET level II technician shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

END OF SECTION 283111

SECTION 31 00 00 – EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes:
 - 1. General site grading
 - 2. Earthwork for structures and utilities

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 QUALITY ASSURANCE

- A. Soil Testing
 - 1. The Owner will engage a Geotechnical Consultant to test soil materials proposed for use in the work and for quality control testing during excavation and fill operations.
 - 2. Samples of materials shall be furnished to the Geotechnical Consultant by the Contractor at least one week before their anticipated use.
 - 3. Under this contract, smooth out areas for density tests and otherwise facilitate testing work as directed.

1.4 EXISTING CONDITIONS

- A. Site Information: Subsurface conditions were investigated by Pacific Testing & Inspections and documented in a report dated November 16, 2020.

PART 2 - PRODUCTS

2.1 STRUCTURAL FILL

- A. Structural fill shall be on-site or imported well graded granular material free of organics and debris in accordance with Section 9-03(14) of the WSDOT Standard Specifications for gravel borrow. Maximum particle size 4 inches and no more than 5 percent fines (material passing No. 200 sieve).

2.2 NONSTRUCTURAL FILL

- A. Nonstructural fill shall be on-site or imported well-graded granular material free of organics and debris. Maximum particle size 4 inches and no more than 30 percent fines (material passing No. 200 sieve). Material shall be capable of being compacted as specified under the weather conditions prevailing at time of construction.

2.3 COMMON BORROW

- A. Common borrow shall conform to Section 9-03.14(3) of the WSDOT Standard Specifications.

2.4 GRAVEL BORROW

- A. Gravel borrow shall conform to Section 9-03.14(1) of the WSDOT Standard Specifications.

2.5 GRAVEL BACKFILL FOR PIPE ZONE BEDDING

- A. Gravel backfill for pipe zone bedding shall conform with Section 9-03.12(3) of the WSDOT Standard Specifications.

2.6 GRAVEL BACKFILL FOR WALLS

- A. Gravel backfill for walls shall conform to Section 9-03.12(2) of the WSDOT Standard Specifications.

2.7 PIPE ZONE BACKFILL

- A. Pipe Zone Backfill shall conform to Section 7-08.3(3) of the WSDOT Standard Specifications.

2.8 SAND

- A. Sand shall conform with Section 9-03.13 of the WSDOT Standard Specifications.

2.9 GRAVEL BACKFILL FOR DRAINS

- A. Gravel backfill for drains shall conform to Section 9-03.12(4) of the WSDOT Standard Specifications.

2.10 QUARRY SPALLS

- A. Quarry spalls shall be crushed quarry rock. Spalls shall be hard, sound and unweathered. Quarry spalls shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
6-inch	100
3-inch	40 max.
3/4-inch	10 max.

2.11 CAPILLARY BREAK

- A. Capillary break material shall have 100% passing the 3/4-inch sieve and less than 10% passing the #200 sieve.

2.12 GEOTEXTILE

- A. Geotextile for grade separation shall conform to Section 9-33.2(1) of the WSDOT Standard Specifications.

2.13 DETECTABLE WARNING TAPE

Detectable underground warning tape shall be yellow imprinted in black letter with the message "GAS LINE BURIED BELOW" or equal. The warning tape shall be polyethylene with a metallic backing. The polyethylene shall be a minimum of 4 mils thick and 3 inches wide.

2.14 TRACER WIRE

- A. Tracer wire shall be steel core copper clad minimum size AWG 14 insulated conductor. The insulation shall be orange High Molecular Weight High Density Polyethylene (HMHDPE).

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Owner's Representative. Unauthorized excavation, as well as remedial work directed by the Owner's Representative, shall be at no change in contract amount.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation with CDF or lean mix concrete. The bottom width of the excavation shall be defined by a line extending downward and out from the outer edge of the footing at an angle of 1H:1V.
 2. Elsewhere, backfill and compact unauthorized excavations with structural fill as specified herein.
- B. Overexcavation: In certain areas where soft spots occur in the subgrade, satisfactory sub-grade shall be achieved by overexcavation and replacement with structural fill material or lean mix concrete.
1. Location and extent of soft spot areas to be verified by Owner's Geotechnical Consultant in the field.
- C. Stability of Excavations: Slope the sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling. Temporary and permanent earth cuts and fill slopes exceeding 4 feet in height should be limited to a slope of 2:1 (horizontal:vertical).
- D. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.
 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure to convey water. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile excavated materials as required. Place, grade, shape and cover stockpiles for proper drainage and to prevent accumulation of excess moisture.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil material and waste materials legally off-site.
- F. Excavation for Buildings
1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10-foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and inspection.
 2. In excavating for footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete. Compact base to the density required and allow testing of compaction prior to constructing concrete forms.
 3. Place footings on native soils, or properly compacted fill material. Where existing soft materials are encountered below footings, overexcavate as required by the Owner's

Geotechnical Consultant or until dense native soil is encountered and backfill with lean concrete. The minimum lateral limits of the overexcavation and lean concrete backfill beneath footings shall be defined by a line extending downward and out from the outer edge of the footing at an angle of 1H:1V. Maintain side slopes as required by authorities having jurisdiction.

- G. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown within a tolerance of plus or minus 0.10-foot.
- H. Excavation for Planting Areas: Conform to cross-sections, elevations and dimensions shown, within a tolerance of plus or minus 0.10-foot.
- I. Excavation for Trenches
 - 1. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.
 - 2. Where rock is encountered, carry the excavation 6 inches below the required elevation and backfill with a 6-inch layer of structural fill.
 - 3. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe.
- J. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.2 SUBGRADE VERIFICATION

- A. Following site preparation and excavation for the building, paved surfaces and roadways, the exposed subgrades shall be observed and approved by the Owner's Geotechnical Consultant.
- B. Overexcavate any soft, loose or disturbed soils identified by the Geotechnical Consultant and replace with compacted structural fill.
- C. If required by Geotechnical Consultant, provide equipment and labor for proofrolling.

3.3 BACKFILL AND FILL

- A. For backfill of all excavations use material sampled and tested by the Owner's Geotechnical Consultant.
- B. All fill used for the following shall be structural fill:
 - 1. Fill beneath footings and foundations.
 - 2. Backfill against footings, foundations and structural walls, except 18 inches of gravel backfill for walls shall be placed immediately adjacent to structures for drainage, unless otherwise shown on the drawings.
 - 3. Fill beneath building slabs.
 - 4. Fill within 3 feet vertically of the base of pavements

- C. Fill beneath areas to be landscaped shall be nonstructural fill.
- D. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance by Owner's Representative of construction below finish grade including, where applicable, waterproofing, dampproofing, piping, conduits and perimeter insulation.
 - 2. Inspection, testing, approval and recording locations of underground piping and conduits. Coordinate locations with surveyor for as-built survey.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing and backfilling of voids with satisfactory materials.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- E. Ground Surface Preparation
 - 1. Remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface prior to placement of fills. On existing sloped surfaces, steeper than 1 vertical to 4 horizontal, cut benches into hillsides of 10 feet minimum width and 5 feet maximum height.
 - 2. When existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, moisture-condition to within 2 percent of the optimum moisture content, and compact to required depth and percentage of maximum density.
- F. Placement and Compaction: Allowable thickness of fill lifts will depend on the material type and compaction equipment used. In no case place backfill and fill materials in layers more than 8 inches in loose depth for material compacted by heavy compaction equipment, and more than 4 inches in loose depth for material compacted by hand-operated tampers. For fill deeper than 3 feet below the base of pavements, lifts may be 12 inches maximum in loose depth.
 - 1. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content.
 - 2. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
 - 3. Do not place backfill or fill material on surfaces muddy, frozen, or containing frost or ice.
 - 4. Place backfill and fill materials in such a manner as to prevent wedging action of backfill against structures.

3.4 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area.

- B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density determined in accordance with ASTM D 1557 ("Modified Proctor"):
 - 1. Structures: Compact top 12 inches of subgrade where exposed, and each layer of backfill or fill material to 95 percent of maximum dry density.
 - 2. Building Slabs and Steps: Compact top 12 inches of subgrade and each layer of backfill or fill material to 95 percent of maximum dry density.
 - 3. Lawn or Unpaved Areas: Compact top 12 inches of subgrade and each layer of backfill or fill material to 85 percent of maximum dry density.
 - 4. Walkways: Compact top 12 inches of subgrade and each layer of backfill or fill material to 95 percent of maximum dry density.
 - 5. Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 95 percent of maximum dry density.
 - 6. Utility Bedding and Backfill: Compact each layer of bedding and backfill to 95 percent of maximum dry density.
 - 7. Granular Fill Placed Against Subgrade Walls: Compact to 90 percent of maximum with small hand-operated equipment to avoid overcompaction.
- C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Prevent free water from appearing on surface during or subsequent to compaction operations.
 - 1. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
 - 2. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.5 GRADING

- A. General: Uniformly grade areas of work including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces shall be free from irregular surface changes.
- C. Compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.
- D. Compaction: After grading, compact surfaces to the depth and percentage of maximum density for each area classification.

3.6 WET WEATHER PROVISIONS

- A. Schedule earthwork operations to minimize the potential for erosion, siltation, and disturbance of site soils.
- B. Perform earthwork operations in discrete areas as required to minimize the exposure of disturbed soils to wet weather.
- C. Compact exposed soil to reduce the infiltration of rain water.
- D. Direct surface water away from fills and excavations.
- E. Provide temporary pumping equipment to keep excavations and construction free of water.
- F. Soils that become too wet for compaction shall be removed and replaced with compacted structural fill.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Transport acceptable excess excavated material to temporary stockpile areas on the Owner's property. Remove any unused excess excavated material from the site, and dispose of legally off the Owners property, prior to final inspection.
- B. Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of legally off the Owner's property.

3.8 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow Owner's Geotechnical Consultant to observe, test and approve subgrades and fill layers before further construction work is performed.
- B. Footings for structures shall be observed by the Geotechnical Consultant for bearing capacity verification prior to concrete placement. Compaction tests shall be performed if in the opinion of the Geotechnical Consultant they are necessary.
- C. If subgrades or fills which have been placed are below specified density, provide corrective work as specified at no additional expense.

3.9 PROTECTION

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work as specified, with retesting, prior to further construction.

CHEHALIS ELDERS CENTER
100% CONSTRUCTION

EARTHWORK

END OF SECTION 31 00 00

SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes clearing and grubbing areas within the boundary limits shown on the plans or staked by the Engineer. This work also includes protecting from harm all trees, bushes, shrubs or other objects selected to remain.
 - 1. "Clearing" means removing and disposing of all unwanted material from the surface such as trees, brush, down timber or other natural materials.
 - 2. "Grubbing" means removing and disposing of all unwanted vegetative matter from underground such as sod, stumps, roots, buried logs or other debris.
 - 3. "Debris" means all nonusable natural material produced by clearing and grubbing.

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

- 3.1 LEED: Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - A. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.

3.2 DISPOSAL

- A. Disposal shall be in conformance with Section 2-01.2 of the WSDOT Standard Specifications and local jurisdiction requirements except that on-site burning shall not be allowed.

3.3 CLEARING

- A. Clearing shall be in conformance with Section 2-01.3(1) of the WSDOT Standard Specifications.

3.4 GRUBBING

- A. Grubbing shall be in conformance with Section 2-01.3(2) of the WSDOT Standard Specifications.

END OF SECTION 31 11 00

SECTION 32 01 80 – OPERATION AND MAINTENANCE OF IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of providing supervision, labor and materials to maintain all new irrigation systems during the one-year maintenance period. The maintenance contract shall begin at the date of Substantial Completion and terminate 365 days after.

1.2 EQUIPMENT

- A. Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

1.3 RELATED WORK

- A. Section 32 01 90 – OPERATION AND MAINTENANCE OF PLANTING
- B. Section 32 84 00 – PLANTING IRRIGATION
- C. Section 32 90 00 – PLANTING

1.4 QUALITY ASSURANCE

- A. Experience: Contractor's maintenance crew shall be experienced in maintaining irrigation systems.
- B. Contractor shall provide all irrigation maintenance equipment necessary for the contract.
- C. Contractor shall submit monthly Report to the Owner's Representative stating:
 - 1. Irrigation schedule including precipitation rates per zone, per month.
- D. Begin soil moisture monitoring by April 1 to assure that plants are adequately watered at the beginning of the growing season in spring and continue through November 1.

1.5 SUBMITTALS

- A. Submit in accordance with:
 - Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Irrigation plan for vegetated roof plants developed by plant supplier
- C. Monthly Report

PART 2 - PRODUCTS

2.1 SLOW RELEASE WATERING BAGS

- 1. Model: Treegator® Original

2. Manufacturer: Treegator, or approved equal.
3. Made in the USA.
4. Size: 30" ht x 18" width (at base)
5. Capacity: 15 gallons (56.78 liters)
6. Warrantee: five years
7. URL: treegator.com
8. Local Dealer: H.D. Fowler Company
8950 Tilley Rd SE, Tumwater, WA 98501
360-459-7300

PART 3 - EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 TREE, SHRUB, PERENNIAL AND GROUNDCOVER CARE

- A. Watering:
 1. All trees, shrubs, perennials, and groundcovers shall be watered by thorough deep watering at least every week during the dry season (May 15 to October 1), or as necessary, to keep the ground moist to a depth of at least 12 inches, to keep the plants healthy and vigorous, and to prevent wilting. Do not over water.
 2. If hand watering, use a fine spray water wand, and water deeply.

3.3 IRRIGATION SYSTEM

- A. Perform inspections at regular bi-monthly intervals to ensure the weather station and all other sensors are operational and connected to the central control system. Repair irrigation components immediately upon discovery of defects and keep operational at all times. Contractor shall provide supplemental hand watering if necessary.
- B. Seasonal Shutdown and Start Up.
 1. At the end of the watering season (typically in November) drain irrigation system by opening drain valves and blowing system out with compressed air. Shut down controller.

2. At the beginning of the watering season (typically in March) start up the irrigation system by closing all drain valves, refilling and pressurizing the system and reprogramming the controller.
3. Irrigation system to be turned off after two years. Do not remove irrigation system. System can be turned on only during seasons of extreme drought for the remaining life of the project.

C. Watering Program:

1. In areas watered by an automatic irrigation system, program controls and maintain a record of watering program. Provide copies to Owner's Representative.

D. Tree Gators

1. Provide slow release watering bags to any tree that is not receiving adequate water coverage during first year from the main system and any tree that requires additional water for survival during the second year.
2. Field monitor once a week to ensure that the tree diaper system is operating properly.
3. Refill tree gators during drought periods per the manufacturer's specifications.
4. Maintain 4" of arborist wood chip mulch min. 4' radius around base of tree, per details.
5. After a minimum of two years, the tree gators can be removed and stored for future use if determined to be in good repair.

3.4 ON-SITE MEETINGS

- A. Owner's Representative and Contractor shall conduct an on-site review of irrigation maintenance work monthly during March – October, and bimonthly during remaining months. The Owner's Representative shall provide written notification of corrections to work.
- B. Replacement of stolen or vandalized irrigation equipment:
 1. Notify Owner's Representative immediately of losses and damages, with follow-up report in writing. Owner's Representative shall decide whether the replacement shall be done and by whom. The costs for replacement or repair other than as specified in irrigation routine maintenance shall be a reimbursable expense within the maintenance agreement.

3.5 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

- A. At completion of the contract period, the substantial completion inspection shall be performed by the Owner's Representative and the Contractor. In this inspection, the irrigation system components and their operation will be reviewed and a punch list of any items needing correction will be prepared.
- B. Final Inspection:
 1. Notify the Owner's Representative at least three (3) days before anticipated inspection.

2. Replace defective materials noted and upon completion of replacements, the Owner's Representative will verify final acceptance in writing.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of providing supervision, labor and materials to maintain all new landscaping during the maintenance period.
- B. Duration: The maintenance period shall begin at the date of Substantial Completion and terminates as follows:
 - 1. Plant Maintenance, which includes maintaining all installed plants, plant beds, rain gardens, shall begin at the date of installation and terminate one year (365 days) after Substantial Completion.

1.2 EQUIPMENT

- A. Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

1.3 RELATED WORK

- A. Section 32 90 00 – PLANTS

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Product Literature for:
 - 1. Fertilizer identifying manufacturer and showing composition by weight.

1.5 QUALITY ASSURANCE

- A. Experience: Contractor's maintenance crew shall be experienced in landscape maintenance and shall have adequate knowledge of ornamental horticulture and integrated pest management (IPM) practices.
- B. Unless approved by Owner's Representative, herbicides, pre-emergent herbicides, and insecticides are not allowed for general weed and pest control. Before use of any herbicides, insecticides, or disease control chemicals, secure Owner's Representative's written approval. Furnish the Owner's Representative with a monthly record of all herbicides, insecticides and disease control chemicals used, if any.
- C. Contractor shall provide all grounds maintenance equipment necessary for the contract.
- D. Contractor shall submit a monthly letter report to the Owner's Representative stating:
- E. Schedule of maintenance activities completed
- F. Begin soil moisture monitoring by April 1 to assure that plants are adequately watered at the beginning of the growing season in spring.

PART 2 - PRODUCTS

- A. Fertilizer: 100% organic bridge-type fertilizer (part natural, part synthetic slow release) (7-4-9) as follows:

Total Nitrogen (N)	7%
0.5% nitrate nitrogen (N)	
6.5% water insoluble nitrogen (N)	
Available Phosphoric Acid (P2O5)	4%
Soluble Potash (K2O)	9%
Calcium	7%
Shall be derived from: Fish meal, crab meal fines, kelp meal, fish bone meal, and agricultural gypsum.	

PART 3 - EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 GENERAL LANDSCAPE MAINTENANCE

- A. Frequency: Visit site once per week and provide the maintenance operations specified.
- B. Watering: As specified in Section 32 01 80.
- C. Trash Removal: Remove trash and debris from all pavement, and planted areas.
- D. Near areas of open flame:
1. Limb trees to a height of 30' within 30' of the flame source.
 2. Remove dead plants/leaves/branches prior to starting a fire within 30' of the fire circle.
- E. Weed Control: Keep planted areas free of weeds. Do not use broadcast herbicides. Remove weeds manually by pulling. Avoid frequent soil cultivation that destroys shallow roots of trees and shrubs.
- F. Insect and disease control: Maintain a reasonable control with approved materials, using best management practices and least toxic methods.
1. Prior to use of any pesticide, submit written request for use, explaining reason for use, and proposed application, and obtain approval from Owner's Representative.

- G. Mulching: Replenish mulch in each planted area, planting bed, and rain garden (bioretention area) with specified mulch for each respective area to maintain full depth as indicated in the specifications.
- H. See 32 90 00 Planting for mulch specifications.
- I. Replacement of Plants: Report dead and dying plants immediately to Owner's Representative, and replace within 30 days of notification by Owner's Representative with plants of equal size, condition, and variety of original planting.
- J. Leaf Removal: Remove fallen leaves from pavement and planted areas once every two (2) weeks within the dates October 15 to December 15. Prior to and after this time period, leaf litter shall be removed from paved areas and surface drainage structures on a once per month basis.
- K. Protection from Foraging: Implement measures to prevent damage to plants by browsing from mammals (deer, rabbits, mice, voles, etc.)

3.3 TREE AND SHRUB CARE

- A. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
- B. Pruning of Deciduous Trees: Prune trees during the dormant season to facilitate the following:
 - C. To eliminate diseased or damaged growth.
 - D. To encourage natural shape and balance.
- E. Pruning of Coniferous Trees: Prune only to eliminate diseased or damaged growth.
- F. Pruning of Shrubs: Follow procedures as outlined for deciduous trees. Do not prune or shear shrubs into ball shapes, and do not prune off lower branches. Allow shrubs to spread and form masses to prevent weed growth below the shrubs.
- G. Pruning Cuts: Make all cuts at lateral branches or buds, or trunk. Cut at the edge of the branch collar. Do not cut the collar.
- H. Staking: Repair tree stakes as needed. Remove stakes as soon as they are no longer needed, but no later than one year after installation. Inspect and adjust stakes and connections to provide support, to prevent girdling of trunks or branches, and to prevent rubbing that causes bark wounds.
- I. Fertilization:
 - 1. Fertilize in two (2) applications - early spring and late spring, all recently established plants. Follow manufacturer's recommendations for application rate. Provide three (3) pounds of nitrogen per 1,000 square feet.
 - 2. Avoid applying fertilizer to root ball and base of main stem. Spread evenly under plant to drip line.
 - 3. DO NOT apply fertilizer, herbicides, or pesticides in or around rain gardens (bioretention facilities) and bios wales.

3.4 GROUNDCOVER AND PERENNIAL CARE

- A. Fertilize in two (2) applications, early spring and late spring. Follow manufacturer's recommendations for application rate. Provide a minimum of four (4) pounds of nitrogen per 1,000 square feet.
- B. Deadhead flowering perennials after each species finishes flowering. Clean up dead leaves and debris in the fall. Remove old, dying fern fronds and cut back deciduous ornamental grasses in early spring. Do not cut ornamental grasses in the fall or winter.

3.5 BIORETENTION AREAS

- A. Keep rain garden (bioretention areas) free of sediment and debris. If sediment has accumulated in the basin following a rain event remove sediment from the surface within seven days and reapply arborist wood chip mulch to affected area to prevent the transfer of sediment down into the bioretention soils and underdrain.
- B. Eliminate causes of and repair erosion (gullies/rills) greater than 2 inches deep around inlets, outlets, and along side slopes.
- C. Clear blockages of inlets and outlets.
- D. Monitor pipe discharge points for erosion. Repair rock zones as required.
- E. Notify Owner's Representative immediately if the bioretention area is exhibiting ponding of water longer than 48 hours.
- F. Review civil engineers specifications for additional instruction and maintenance procedures.

3.6 ON-SITE MEETINGS

- A. Owner's Representative and Contractor shall conduct an on-site review of maintenance work monthly during March – October, and bimonthly during remaining months. The Owner's Representative shall provide written notification of corrections to work.

3.7 REPLACEMENT OF STOLEN OR VANDALIZED PLANT MATERIAL

- A. Notify Owner's Representative immediately of losses and damages, with follow-up report in writing. Owner's Representative shall determine if plant losses are due to theft or vandalism. Contractor will not be held responsible for loss or damage to due to theft or vandalism.

3.8 SUBSTANTIAL COMPLETION AND FINAL INSPECTION

- A. At completion of the maintenance period, a substantial completion inspection shall be performed by the Owner's Representative and the Contractor. In this meeting, a punch list of incomplete scope items needing to be addressed by the Contractor will be developed.
- B. Final Inspection:
 - 1. Notify the Owner's Representative at least three (3) days before anticipated inspection.

Replace defective materials noted and upon completion of replacements, the Owner's Representative will verify final acceptance in writing.

3.9 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 32 11 16 – BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes constructing crushed aggregate top course and base course beneath all new pavement for parking areas and roads and concrete pads as shown on the plans.

1.2 LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15- LEED Certification Procedures.

- A. LEED Submittal Coversheet.
- B. Materials and Resources Submittals:
 - 1. MR Credit BPDO – Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with 01 35 15 – LEED Certification Procedures.
 - a. Include manufacture documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles.

1.3 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections, and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 TOP COURSE AND BASE COURSE

- A. Top Course and Base Course shall conform with the requirements for crushed surfacing top course and Base Course as specified in Section 9-03.9(3) of the WSDOT Standard Specifications.

PART 3 - EXECUTION

- 3.1 LEED: Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following credits:
- A. Sustainable Sites—Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - B. Materials & Resources—Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.
 - C. Top Course and Base Course shall be placed and compacted in conformance with Section 4-04.3 of the WSDOT Standard Specifications, except that the base course shall be compacted to 95 percent of the maximum dry density as determined in accordance with ASTM D 1557.

END OF SECTION 32 11 16

SECTION 32 12 16 - ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Asphalt concrete pavement for roadways and parking.

1.2 LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15- LEED Certification Procedures.

A. LEED Submittal Coversheet.

1. Materials and Resources Submittals:
2. MR Credit BPDO – Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with 01 35 15 – LEED Certification Procedures.
 - a. Include manufacture documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles.

1.3 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections, and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 TACK COAT

- A. Tack coat shall be ASTM D977 emulsified asphalt or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted with water at a rate not to exceed one part water to one part emulsified asphalt, of suitable grade and consistency for application.

2.2 ASPHALT CONCRETE

- A. Asphalt concrete shall be Class 1/2-inch with aggregate conforming to Section 9-03.8 and asphalt PG 58 H-22 conforming to Section 9-02.1(4) of the WSDOT Standard Specifications. Asphalt percentage of the total mixture shall be 5.0 to 7.5 percent.

PART 3 - EXECUTION

- 3.1 LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15- LEED Certification Procedures.

- A. LEED Submittal Coversheet.
 - 1. Materials and Resources Submittals:
 - 2. MR Credit BPDO – Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with 01 35 15 – LEED Certification Procedures.
 - a. Include manufacture documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles.

3.2 TACK COAT

- A. Tack coat shall be placed in conformation with Section 5-04.3(4) of the WSDOT Standard Specifications.

3.3 ASPHALT CONCRETE PAVEMENT

- A. Asphalt concrete pavement shall be constructed in conformance with Section 5-04.3 of the WSDOT Standard Specifications, except as modified herein.
- B. Asphalt concrete pavement more than three inches thick shall be placed in multiple layers. Each layer shall not exceed three inches in thickness or be less than two inches. Asphalt concrete pavement three inches thick or less may be placed in one layer.

END OF SECTION 32 12 16

SECTION 32 16 13 – CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Cement Concrete Pavement
2. Section 01 35 15 LEED Certification Procedures for additional LEED requirements.

1.2 LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15- LEED Certification Procedures.

A. LEED Submittal Coversheet.

B. Materials and Resources Submittals:

1. MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
2. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - a. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
3. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.3 STANDARD SPECIFICATIONS

- A. All Work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.

- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 CEMENT CONCRETE PAVEMENT MIX

- A. Use a current WSDOT mix design for Portland cement concrete pavement. Comply with Section 5-05.3(1) of the Standard Specifications.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: Per Section 9-07 of the Standard Specifications.
- B. TIE AND DOWEL BARS
 - 1. Dowel bars shall conform to WSDOT Standard Specifications, section 9-07.5.
 - 2. Tie bars shall conform to WSDOT Standard Specifications, section 9-07.6.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement Concrete: Shall conform to Section 9-01 of the WSDOT Standard Specifications. Normal use shall be Type I or Type I/II.
- B. Normal-Weight Aggregates: Per section 9-03.1 of the WSDOT Standard Specifications, uniformly graded. Provide aggregates from a single source.
- C. Air-Entraining Admixture: Section 9-23.6(1) of the WSDOT Standard Specifications.
- D. Chemical Admixtures, as needed: Section 9-23 of the WSDOT Standard Specifications.

2.4 CURING MATERIALS

- A. Moisture-Retaining Cover: Section 9-23 of the WSDOT Standard Specifications.

2.5 RELATED MATERIALS

- A. Joint Fillers: Per Section 9-04 Joint and Crack Sealing Materials in the Standard Specifications.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.

2.7 STAMPED CONCRETE

- A. All pertinent manufacturers' information for stamped concrete systems shall be submitted for approval by the architect and engineer.

PART 3 - EXECUTION

- 3.1 LEED: Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:

- A. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
- B. Materials & Resources – Construction Waste Management: Comply with provisions of 01 74 00 Construction Waste Management.

3.2 PREPARATION

- A. Visually inspect and perform compaction tests on subbase and base surfaces below concrete equipment pad to identify soft pockets.
- B. Prior to placing concrete ensure the base course is in a saturated surface dry condition and that no deleterious materials have collected on the compacted surface to receive concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least until final setting of concrete.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Comply with section 5-05.3(8) of the WSDOT Standard Specifications.

B. CONTROL JOINTS

1. Saw cut control joints to dimensions indicated on the drawings.
2. Saw cut as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw. Complete within 24 hours after concrete placement.

3.6 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- B. Comply with section 5-05.3 of the WSDOT Standard Specifications requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed paving surface with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations. Comply with section 5-05.3(11) of the WSDOT Standard Specifications.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/32 inch deep with a stiff-bristled broom.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect and cure per sections 5-05.3(13) through 5-05.3(17) of the WSDOT Standard Specifications.

3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 1. Elevation: 3/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10 feet long; unlevelled straightedge not to exceed 1/4 inch.

3.10 REPAIR

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by the Owner Representative.
- B. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.11 STAMPED CONCRETE

- A. Work associated with the installation of the stamped concrete surfaces shall be performed by a trained and certified contractor for the products used. All work shall meet the manufacturer's specifications and recommendations for an installation of this type.

END OF SECTION 32 16 13

SECTION 32 14 16 – BRICK UNIT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. This technical specification covers the furnishing of all labor, materials, testing, submittals, tools, and equipment necessary to construct brick paving, or reset brick and other paving materials such as stone, slate, etc., as shown on the plans or as directed by the Engineer. Prior to installation of the bricks, all work within the brick paver limits shall be complete and shall include, but not be limited to, the adjustments of all public and private frames, grates, covers and utility boxes.
- B. This Section includes:
 - 1. Brick Soldier Course set in mortar on compacted gravel base.

1.2 RELATED SECTIONS

- A. Section 033000 – Cast-in-Place Concrete

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 144-11 – Aggregate for Masonry Mortar.
 - 2. ASTM C 150/C 150M-16 - Portland Cement.
 - 3. C207-06(2011) – Hydrated Lime for Masonry Purposes
 - 4. C270-14a – Mortar for Unit Masonry
 - 5. ASTM: C 902-04, Class SX, Type II

1.4 SUBMITTALS

- A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submittal Drawings:
 - 1. Show brick paving layout and patterns.
 - 2. Show special brick shapes.
- C. Manufacturer's Literature and Data:
 - 1. Description of each product.
- D. Samples:
 - 1. Brick: Full size of each type and color.
 - a. Minimum five individual samples to show full color and texture range.

2. Mortar: Samples of brick with mortar joints of each color.

1.4 LEED SUBMITTALS

- A. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.

1. LEED Submittal Coversheet

2. Materials and Resources Submittals:

- a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 QUALITY ASSURANCE

- A. Paver Installation Contractor Qualifications:

1. Utilize an installer having successfully completed a minimum of 3 brick paving slab installations similar in design, material, scope and extent indicated on this project.

- B. Mock-Ups:

1. Install a 2 m x 2 m (6 ft x 6 ft) area.
 2. Use this area to determine pedestal height and shimming requirements, joint sizes, lines, laying pattern(s), color(s), and texture of the job.
 3. This area will be used as the standard by which the work will be judged.
 4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
 5. If mock-up is not retained, remove, and properly dispose of mock-up.

1.6 DELIVERY, STORAGE, AND HANDLING

- B. General: Comply with Division 1 Product Requirement Section.

- C. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

- D. Delivery: Deliver materials to project site in manufacturer's original, unopened, undamaged packaging with identification labels intact. Confirm that the correct product has been delivered to the job site before commencing off loading.

1. Coordinate delivery and paving schedule to minimize the interference with normal use of buildings adjacent to paving.

2. Deliver brick paving to the site in steel banded, plastic banded or plastic wrapped packaging capable of transfer by forklift or clamp lift.
 3. Unload slabs at job site in such a manner that no damage occurs to the product.
- E. Storage and Protection: Store materials protected such that they are kept free from mud, dirt, and other foreign materials.

1.7 PROJECT / SITE CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
1. Do not work during freezing weather or on wet or frozen sub-base.

1.8 MAINTENANCE

- A. Extra Materials: Provide 10% additional material for use by owner for maintenance and repair including pedestals.
- B. Slabs shall be the same production run as installed materials.

PART 2 PRODUCTS

2.1 SYSTEM PERFORMANCE

- A. Design brick complying with specified performance:
1. Slip Resistance: ASTM C902

2.2 MANUFACTURERS

- A. Acceptable Manufacturer:
- Mutual Materials
605 119th Ave NE, Bellevue, WA 98005
(425) 452-2363

2.3 BRICKS

- A. Roman Clay Pavers
1. Nominal Size: 2-3/8" x 4" x 8" (60 x 102 x 203 mm)
 2. Color: Inca

2.4 FILTER FABRIC

- A. Filter fabric conforming to Form 817, Section M.08.01.19 shall be used when dry setting brick.

2.5 BASE MATERIALS

- A. The processed aggregate base under the concrete shall be medium gradation conforming to Technical Specification 210 – “Processed Aggregate Base”.

2.6 LEVELING COURSE

- A. The leveling course for dry set bricks shall be commercial grade crushed stone dust.

2.7 JOINTS

- A. The paver joints shall be filled with either commercial grade polymeric stabilizing sand or mortar, as shown on the plans or as directed by the Engineer.

2.8 MORTAR

- A. The base material leveling course for mortar set brick shall be Portland Cement Concrete which shall conform to all provisions of Technical Specification 265 – “Portland Cement Concrete Sidewalks and Ramps”.

2.9 EDGE RESTRAINTS

- A. Edge restraints shall be snap-edge Pave Tech – Pave Edge, or approved equivalent.

PART 3 EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 - 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 - 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Do not begin paving work until such conditions have been corrected to the Owner's Representative satisfaction and are ready to receive leveling materials and paving slabs.

3.3 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.

3.4 BRICK INSTALLATION

- A. Do not use bricks with chips, cracks, discoloration, or other visible defects.
- B. Layout brick paving according to pattern indicated on drawings.
- C. Installation with Portland Cement Mortar:

1. Install brick in full bed joint. Remove excess mortar. Strike joints flush with top surface of brick and tool slightly concave.
2. Cure mortar by maintaining damp condition for seven days.

D. Installation Tolerances:

1. Finished surface true to plane within 1 mm in 1000 mm (1/8 inch in 10 feet), non-cumulative.
2. Install pavers to vary not more than 1 mm in elevation between adjacent pavers or more than 2 mm variation from surface plane elevation of cast-in-place concrete plaza paving.
3. Joint width deviation maximum 25 percent of dimension indicated.
4. Field cutting: Use masonry saws to cut bricks. Produce lines cut straight and true, with edges eased slightly to prevent chipping. Do not cut on top of other bricks as you will generate a slurry mix. This slurry mix, if allowed to dry, will leave a permanent cement residue on the bricks.

3.2 SURFACE PREPARATION

- A. Examine and verify substrate suitability for product installation.
 1. Verify substrate depth accommodates brick paving installation thickness.
- B. Protect existing construction and completed work from damage.
 1. Prevent damage from contact with mortar.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.1 PROTECTION AND CLEANING

- A. Clean exposed brick and mortar surfaces.
 1. Remove excess mortar before fully set.
- B. Remove contaminants, stains, spillage and soiling from adjacent construction using cleaning agents and procedures recommended by the manufacturer of the affected construction.
- C. In order to protect their aesthetic appearance, all brick and concrete work should be installed as the final stage of the construction project. If this is not possible, then it is imperative that a protective covering be placed over them until all other sub-trades have completed their work. After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.
- D. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 321543 – STABILIZED AGGREGATE PATHWAY

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes material and labor requirements for construction with decomposed granite or crushed 3/8" or 1/4" minus aggregate pathway with Stabilizer® binder additive for the following items:
 - 1. Stabilized Aggregate pathway and patios
 - 2. Related Sections:
 - a. Section 015639 – Temporary Tree and Plant Protection
 - b. Section 310000 – Earthwork
 - c. Section 321100 – Stabilizer® for Stabilized Aggregate Pavement.

1.02 PERFORMANCE REQUIREMENTS

- A. Perform gradation of decomposed granite material or 3/8" or 1/4" minus crushed aggregate in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Coarse Aggregates.

1.03 SUBMITTALS

- A. Products Data: For each product specified. Submit a 5 lb. sample and sieve analysis for grading of decomposed granite or crushed 3/8" or 1/4" minus aggregate to be sent to Stabilizer Solutions, Inc. prior to any construction – (allow 2-week turn around). Must be approved by Landscape Architect and Owner.
- B. Shop Drawings: Show details of installation, including plans and sections.
- C. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - (i) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
- D. Maintenance Instructions: Submit copy(ies) of manufacturer's written maintenance instructions in accordance with 017323 – Operation and Maintenance Data.

1.04 PROJECT/SITE CONDITIONS

- A. Field Measurements: Each bidder is required to visit the site of the Work to verify the existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.

1. Where surfacing is indicated to fit with other construction, verify dimensions of other construction by field measurements before proceeding with the work.
2. Environmental Limitations: Do not install Stabilized Aggregate pathway during rainy conditions or below 40 degrees Fahrenheit and falling.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing Stabilized Aggregate surface or ability to follow installation instructions.
- B. Mock-ups: Install 4 ft. wide x 10 ft. long mock-up of decomposed granite or 3/8" or 1/4" minus crushed aggregate surfacing with Stabilizer® additive at location specified by owner's representative.
- C. Compaction testing to be provided by contractor, one test per 2,000 square feet of base course.
- D. Manufacturer's technical representative shall visit the site at the start of an installation to ensure the installer understands the correct installation methods to use.

1.06 WARRANTY

- A. 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.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of Stabilized Aggregate that fail in materials or workmanship within the specified warranty period. Stabilizer Solutions, Inc. does not warranty "Stabilizer®" purchased from a non-approved Stabilizer Solutions, Inc. licensee. Failures include, but are not limited to, the following:
 1. Premature wear and tear provided the material is maintained in accordance with manufacturer's written maintenance instructions.
 2. Failure of system to meet performance requirements.
 - a. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.
 - b. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Stabilizer® for Stabilized Aggregate surfaces provided by the following manufacturer:
 1. Stabilizer Solutions, Inc. 33 South 28th St., Phoenix, AZ 85034; phone (602) 225-5900, (800) 336-2468; fax (602) 225-5902; website stabilizersolutions.com; email info@stabilizersolutions.com

2.02 MATERIALS

- A. 1/4" crushed aggregate screenings
 1. Sand and crushed stone shall consist of inert materials that are hard and durable, with

stone free from surface coatings and deleterious materials. Gradation requirements shall be as follows:

2. Crushed Stone Sieve Analysis Percentage of Weight Passing a Square Mesh Sieve AASHTO T11-82 and T2782

1/4" MINUS AGGREGATE GRADATION

U.S. Sieve No.	Percent Passing by Weight
# 3/8"	100
# 4	90 – 100
# 8	75 – 80
# 16	55 – 65
# 30	40 – 50
# 50	25 – 35
# 100	15 – 20
# 200 to	10 – 15

3. Acceptable local supplier list to be provided by Architect
- B. Stabilizer® Binder
1. Patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds decomposed granite or crushed 3/8" or 1/4" minus aggregate.
 2. Product to have 64% pre-consumer recycled content.
 3. Product shall have 25 years experience at same formulation.

2.03 EXCESS MATERIALS

- A. Provide owner's authorized rep. with the following excess materials for use in future Stabilized Aggregate repair: 40 to 50 lb. Bags of the Stabilized Aggregate blended with proper amount of Stabilizer®.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Base shall be 3" compacted layer of your state's DOT recommended crushed granular road base. Make any corrections necessary to base furnished and installed to bring gravel to the elevations shown on the drawing.
- B. Pre-soak base material with water and compact to 95% determined by Test Method ASTM D 1557 prior to installing Stabilized Aggregate. Compaction testing to be provided by project owner, one test per 2,000 square feet of base.
- C. Although porous, it is recommended to have proper drainage available to ensure no standing water on surface or adjacent to Stabilized Aggregate, including downspouts when placed under roof overhang and surface drains.
- D. Before proceeding with installation, notify Owner's Representative in writing of unsuitable site/base conditions.

3.02 BLENDING STABILIZER

- A. Stabilizer® shall be thoroughly pre-mixed with aggregate at the rate of 15-lbs of Stabilizer® per 1-ton of aggregate. Verify with manufacturer correct Stabilizer® rate for your project and climate. Drop spreading of Stabilizer® over pre-placed aggregate or mixing by

rototilling is not acceptable. Stabilizer shall be mechanically pre-mixed per manufacturer's recommendations using an approved mechanical blending unit to adequately blend Stabilizer® with aggregate (Bucket blending is not an approved blending apparatus). Always blend Stabilizer® and aggregate DRY.

3.03 PLACEMENT

- A. After pre-blending, place Stabilized Aggregate directly on prepared sub-grade. Level to desired grade and cross section. Depth of pathways shall be 3" for heavy foot traffic and light vehicles. DO NOT place on filter fabric. Contact Stabilizer Solutions, Inc. for installation on slopes greater than 8%.

3.04 WATERING

- A. Water heavily for full-depth moisture penetration of profile. Water activates Stabilizer®. Apply 25 to 45-gallons of water per 1-ton to achieve saturation. Randomly test for depth using a probing device, which reaches full depth.
- B. Contractor shall wait a minimum of 6 – 72 hours or until such time that the Stabilized Aggregate is able to accept compaction from a 1 to 5-ton roller without separation, plowing or any other physical compromise of the aggregate.
- C. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.

3.05 COMPACTION

- A. Compact Stabilized Aggregate to 85% relative compaction by equipment such as a 2 to 5-ton double drum roller making 3 to 4 passes. Do not begin compaction for 6 hours after placement and up to 72 hours. DO NOT use a vibratory plate compactor or vibration feature on roller, as vibration separates large aggregate particles. If pumping or pancaking of surface occurs, surface is still too wet to roll.
- B. Take care in compacting surface when adjacent to planting and irrigation systems, use 8" or 10" hand tamp. Installation of Stabilized Aggregate more than 3" thick shall be installed in lifts. If 4" thick compacted (2) 2" lifts. If 5" thick compacted (2) 2.5" lifts. If Stabilized Aggregate is pre-moistened before installation entire 4" or 5" lift may be installed.
- C. Lightly spray surface area following compaction. Do not disturb aggregate surface with spray action.

3.06 INSPECTION

- A. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on surface after installation but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a "natural" look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.07 PROTECTION

- A. Contractor shall furnish and install construction fence around new surface to prevent public access. Fencing shall be maintained in place for a minimum of 12 - 72 hours after completion of installation, or as directed by the Owner's Representative. Drying period may take longer due to weather conditions.
- B. Contractor shall notify Owner's Representative that landscape irrigation shall be restricted near Stabilized Aggregate surface until drying period is complete. Standing water on

surface and adjacent to path shall be restricted at all times.

3.08 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

3.09 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, or organic material by mechanically blowing or hand raking as needed. When plowing snow, use rubber baffle on plow blade or wheels on plow to lift blade 1/4" off the surface.
- B. During first year, minor amounts of loose aggregate may appear on surface (1/16 to 1/4"). If material exceeds a 1/4", redistribute over entire surface. Water to 1" depth and compact with power roller of no less than 1000-lbs. Repeat as needed. If cracking occurs, sweep fines into cracks, water thoroughly and hand tamp with an 8" – 10" hand tamp.

3.10 REPAIRS

- A. Excavate damaged area to the depth of the Stabilized Aggregate and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-blend the dry required amount of Stabilizer® with the proper amount of aggregate in a concrete mixer.
- D. Add water to the pre-blended Stabilized Aggregate. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
- E. Apply moistened pre-blended Stabilized Aggregate to excavated area to finish grade.
- F. Compact with an 8" to 10" hand tamp or 250-to-300-pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

END OF SECTION

SECTION 32 16 13 - CEMENT CONCRETE CURB AND SIDEWALKS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Curbs, curbs and gutters, and extruded curbs
2. Sidewalks
3. ADA Ramps

1.2 LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15- LEED Certification Procedures.

A. LEED Submittal Coversheet.

B. Materials and Resources Submittals:

1. MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: Life Cycle Assessments or EPDs in accordance with Section 01 35 15, LEED Certification Procedures.
2. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - a. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
3. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

1.3 STANDARD SPECIFICATIONS

- A. All Work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.

- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland cement shall conform to Section 9-01 of the WSDOT Standard Specifications. Normal use shall be Type II or Type I/II
- B. Fine aggregates shall conform to Section 9-03 of the WSDOT Standard Specifications.

2.2 CONCRETE MIXTURES

- A. Concrete design mixtures shall conform to Section 6-02.3(2)A of the WSDOT Standard Specifications. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete for all classes of concrete specified on the plans.

2.3 PREMOLDED JOINT FILLER

- A. Premolded joint fillers shall conform to Section 9-04.1 of the WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 LEED: Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:

- A. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
- B. Materials & Resources – Construction Waste Management: Comply with provisions of 01 74 00 Construction Waste Management.

3.2 EXAMINATION

- A. Verify base conditions are acceptable for the work anticipated.
- B. Verify gradients and elevations of base are correct per plan.
- C. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

- D. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.3 CONCRETE PLACEMENT

- A. Curb shall be constructed in conformance with Section 8-04.3 of the WSDOT Standard Specifications.
- B. Sidewalk and ADA ramps shall be constructed in conformance with Section 8-14.3 of the WSDOT Standard Specifications.

3.4 PAVING TOLERANCES

- A. Comply with dimensions as shown on the plans with tolerances as follows:
 - 1. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 2. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
 - 3. Joint Spacing: 3 inches.
 - 4. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 5. Joint Width: Plus 1/8 inch, no minus.

3.5 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 32 16 13

SECTION 32 17 23 – PAVEMENT MARKINGS AND SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes:
 - 1. Pavement markings.
 - 2. Traffic control signage.

1.2 LEED SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - 1. LEED Submittal Coversheet.
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1. Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.3 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 PAINT

- A. Paint for pavement markings shall comply with Section 9-34.2 of the WSDOT Standard Specifications. The paint shall be factory mixed, quick drying, and nonbleeding. Colors shall be as indicated on the drawings.

2.2 GLASS BEADS

- A. Glass beads for pavement markings shall comply with Section 9-34.4 of the WSDOT Standard Specifications

2.3 PLASTIC

- A. Plastic for pavement markings shall comply with Section 9-34.3 of the WSDOT Standard Specifications.
- B. Colors shall be as indicated on the drawings.

2.4 SIGNS

- A. Traffic control signs shall be reflective sheeting on sheet aluminum conforming to Sections 9-28.8 and 9-28.12 of the WSDOT Standard Specifications. Posts shall BE Telspar steel posts and conform to Section 9-28.14 of the WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 LEED: Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:

- A. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
- B. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

- 3.2 Pavement markings installation shall conform with Section 8-22.3 of the WSDOT Standard Specifications, except that the Contractor shall be responsible for all layout and control points, striping shall not deviate more than 1/4 inch in 10 feet from a straight line and striping shall not be more than 1 inch from the specified locations. Paint striping shall only be applied after the pavement has been allowed to cure 14 days minimum, when the pavement is clean and dry and when the temperature is above 50 degrees F.
- 3.3 Signs shall be located and installed as shown on the plans. All sign posts shall be plumb and all signs shall be level.
- 3.4 Signs shall be located and installed as shown on the plans. All sign posts shall be plumb and all signs shall be level.
- 3.5 CLEANING
 - A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION 32 17 23

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1.1 SUMMARY

- A. This Section includes:
 - 1. Temporary landscape irrigation systems.
 - 2. Irrigation controllers and accessories.
- B. Related Sections:
 - 1. Division 1 – General Requirements
 - 2. Division 26 – Electrical
 - 3. 03 30 00 – Cast-in-Place Concrete
 - 4. 32 01 80 – Operation and Maintenance of Irrigation
 - 5. 32 90 00 – Planting

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.
- B. Controllers, Sensor-based: Soil-moisture-based irrigation controls that are inserted into the soil to measure moisture enabling irrigation when the plants need water.
- C. Rain Sensors: A rain shut-off device designed to interrupt a scheduled cycle of an automatic irrigation system controller (i.e., timer) when a certain amount of rainfall has occurred.

1.3 SUBMITTALS

- A. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.
 - 3. Water efficiency:
 - a. Indicate water consumption rates in gallons per day (gpd) per unit for the

following:

- 1) Irrigation Systems.
 - b. Water Budget: Peak watering Water Budget not to exceed 77,000 gallons per month.
- B. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.
- C. Submit evidence of installer certification as a WaterSense Certified Irrigation Contractor.

1.4 QUALITY ASSURANCE

- A. Water flow and consumption rates:
 1. Water Budget: Provide irrigation system in accordance with approved water budget for landscape.
 - a. Water schedule: Provide two irrigation watering schedules consistent with overall project Water Budget. One schedule shall address the initial establishment phase of the landscape and the second schedule shall be designed to address an established landscape. Both schedules shall be seasonal in nature. Post both schedules on controller.
 2. Provide WaterSense labeled products for:
 - a. Irrigation controls.
 - 1) Hunter I2C-2400-PL, 24 station outdoor modular controller with two ICM-800 modules. Commercial use. Plastic wall mount cabinet.
- B. Installer Qualifications: Engage an experienced Installer with minimum 3 years' experience with work similar in material, design, and extent to that indicated for this Project and certified as a **Certified Irrigation Contractor (CIC)** through a WaterSense labeled program.
- C. Pre-Installation Meetings:
 1. Convene a pre-installation meeting minimum one week prior to commencing work of this Section.
 2. Require attendance of parties directly affecting Work of this Section.
 - a. Coordinate with installation of planting materials.
 3. Review conditions of operations, procedures, and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of planting materials.
 - b. Review planting schedule and maintenance.
 - c. Review required inspections.
 - d. Review environmental procedures.

- D. Post-Installation Audit: Conduct an audit of the irrigation system immediately after installation by a WaterSense Irrigation Partner.
 - 1. Performance: Assess system performance; verify proper scheduling; identify deficiencies including deficiencies due to damage or modification of system, growth of landscape, or an aging system; identify opportunities to employ new technologies
 - 2. Review maintenance documentation.
 - 3. Leaks: Check for leaks during the post-installation audit.
 - 4. Runoff/overspray: Irrigation systems shall be designed to sustain the landscape without creating runoff or direct overspray during a minimum operating duration. Verify that there is no runoff or overspray during the post-installation audit. Determine the minimum operating duration based on landscape conditions and irrigation system design.
 - 5. Distribution uniformity: Irrigation systems shall achieve a lower quarter distribution uniformity (DULQ) of 70 % or greater. Measure distribution uniformity during the post-installation audit.
- E. Operation and Maintenance Manuals Submittals:
 - 1. Instructions indicating procedures for routine operation and maintenance of the irrigation system, including controllers:
 - a. During first year of plant establishment.
 - b. During one typical year including variations of maintenance for climatic conditions throughout the year.

1.4 MAINTENANCE

- A. Provide regular maintenance for minimum one year from date of Substantial Completion.
 - 1. Monitor system **quarterly** to assess effectiveness. Verify water consumption is consistent with water budget. Verify components are adjusted and functioning properly. Verify that irrigation system pressure is within manufacturer specifications.
 - 2. Document all irrigation water use.
 - 3. Make and document minor adjustments, if any, as necessary.
 - 4. Provide recommendations for improvements to the system.
 - 5. System is to be turned off within one year of installation.

PART 2 - PRODUCTS

2.1 WATER

- A. Water source: Potable.

2.2 IRRIGATION SYSTEMS

- A. Temporary Water Efficient Irrigation System: Equip with pressure regulators, filters, and flush end assemblies. Provide a combined system of the following:
 - 1. MP Rotator and Drip Line system
- B. Manufacturer: Hunter Industries
 - 1. Website: hunterindustries.com

2.3 PIPING

- A. Irrigation Mains: Polyvinyl Chloride (PVC) Pressure Pipe, AWWA C900, PVC 1120, working pressure 150 psi. Pipe shall conform to outside diameters of AWWA 151.
- B. Irrigation Laterals: Polyvinyl Chloride, ASTM D2241, PVC Class 200 1120, SDR 21, solvent welded.
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- D. Above Grade and in Mechanical Pits: AWWA C115, flanged joints and fittings working pressure 150 psi.
- E. Fittings:
 - 1. Irrigation Mains: PVC Pipe, gasketed fittings, ASTM D2466:
 - 2. Irrigation Laterals: PVC, class 200, solvent welded socket type, ASTM D2466.
 - 3. Threaded Pipe: PVC, schedule 80, ASTM D2466.
 - 4. Swing Joints: Threaded fittings with elastomeric seals that allow 360-degree rotation and designed for minimum 1375 kPa (200 psig) working pressure, may be used in lieu of standard threaded fittings.
- F. Jointing Materials:
 - 1. Irrigation Mains: Rubber gaskets, AWWA C111.
 - 2. Irrigation Laterals: Solvent cement, ASTM D2564.

2.3 NOZZLES

- A. MP Rotator nozzles shall be available in the following options:
 - 1. MP Rotator nozzles: approximately 0.2 in/hr (5 mm/hr) precipitation rate
 - a. MP-1000-90, MP-1000-210, MP-1000-360 for an 8–15' (2.5–4.5 m) radius when operating at 30–55 PSI (2.1–3.8 bar; 210–380 kPa)
 - b. MP-2000-90, MP-2000-210, MP-2000-360 for a 13–21' (4.0–6.4 m) radius when operating at 25–55 PSI (1.7–3.8 bar; 170–380 kPa)
 - c. MP-3000-90, MP-3000-210, MP-3000-360 for a 22–30' (6.7–9.1 m) radius when operating at 25–55 PSI (1.7–3.8 bar; 170–380 kPa)
 - d. MP-3500-90 for a 31–35' (9.4–10.7 m) radius when operating at 25–55 PSI (1.7–3.8 bar; 170–380 kPa)

- e. MP-CORNER for an 8-15' (2.5–4.5 m) radius when operating at 25–55 PSI (1.7–3.8 bar; 170–380 kPa)
- B. MP Rotator Strip nozzles: precipitation rate dependent on layout
 - 1. MP-LCS-515, MP-RCS-515, MP-SS-530 for 5' (1.5 m) wide strip models
- C. MP800 nozzles: approximately 0.8 in/hr (20 mm/hr) precipitation rate
 - 1. MP-800SR-90, MP-800SR-360 for 6–12' (1.8–3.5 m) radius when operating at 30–55 PSI (2.1–3.8 bar; 210–380 kPa)
 - 2. MP-815-90, MP-815-210, MP-815-360 for 8–15' (2.5–4.9 m) radius when operating at 30–55 PSI (2.1–3.8 bar; 210–380 kPa)
 - 3. Plastic material description
 - a. The adjustable orifice shall be manufactured from polyurethane and acetal plastic materials for durability and adjustability.
 - b. The acetal material shall have UV stabilizers for outdoor applications.
 - 4. Metal component materials
 - a. The radius adjustment screw, arc ring, spring, and internal collar shall be made of stainless steel.
 - b. The stator that drives the speed of rotation inside the silicone chamber shall be made of brass.
 - 5. Filter screen description
 - a. Each MP Rotator shall come with a detachable filter screen.
 - b. The filter screens shall be made of polypropylene.
 - 6. The screen mesh size shall be dependent on the MP Rotator model.
 - a. 60 mesh: MP800SR90
 - b. 40 mesh: MP1000, MP2000, MP Corner, MP Strips, MP800SR360, MP815
 - c. 20 mesh: MP3000, MP3500
 - 7. Color description
 - a. Each MP Rotator model shall have its own designated color scheme.
 - b. Standard MP Rotator nozzles have a black canister and black top retainer.
 - i. MP-1000-90 (maroon), MP-1000-210 (light blue), MP-1000-360 (olive)
 - ii. MP-2000-90 (black), MP-2000-210 (green), MP-2000-360 (red)
 - iii. MP-3000-90 (blue), MP-3000-210 (yellow), MP-3000-360 (gray)
 - iv. MP-3500-90 (tan)
 - v. MP-Corner (turquoise)
 - vi. MP-LCS-515 (ivory), MP-RCS-515 (copper), MP-SS-530 (brown)
 - vii. The MP800 family has a gray canister and gray top retainer.
 - viii. MP-800SR-90 (orange), MP-800SR-360 (lime green)

- ix. MP-815-90 (maroon), MP-815-210 (light blue), MP-815-360 (olive)

D. Nozzle threads

1. Models MP1000, MP2000, MP3000, MP3500, MP Corner, MP Strips, MP800SR, and MP815 shall be fit for installation in pop-up bodies having a 5/8-27 UNS male-threaded stem at all common pop-up heights.
2. Models MP1000HT, MP2000HT, MP3000HT, MP Corner HT, and MP Strip HT shall be fit for installation in pop-up bodies having a 5/8-28 UNS female-threaded stem at all common pop-up heights.

E. Viscous drive

1. The viscous fluid used to maintain the rotation speed of the MP Rotator shall be made of a silicone material.
2. The silicone chamber shall be sealed with EPDM rubber seals.
3. The brass stator inside the silicone chamber shall control the rotation speed.

F. Warranty

1. MP Rotator nozzles shall have a warranty period of three years.

2.4 DRIP LINE

A. Hunter HDL-06-12-PC

1. Flow: 0.6 gpm
2. Color: Light Brown with gray striping
3. Emitters: 12" O.C.
4. Dripline Lateral Spacing: 12" O.C. with emitters in triangular pattern.
5. Install with Hunter barbed or PLD-LOC fittings.

2.5 CONTROLLERS

A. Irrigation systems shall be equipped with irrigation controllers that contain the following features:

1. Multiple programming capabilities – shall be capable of storing a minimum of three different programs to allow for separate schedules.
2. Multiple start times (cycling, cycle/soak, stackable start times) – shall be capable of a minimum of three different start times to allow for multiple irrigation cycles on the same zone for areas prone to runoff.
3. Variable run times – shall be capable of varying run times, for example one minute to a minimum of one hour.
4. Variable scheduling – shall be capable of interval scheduling (minimum of 14 days) to allow for watering on even day scheduling, odd day scheduling, calendar day scheduling, and interval scheduling.

5. Capability to accept external soil moisture and/or rain sensors.
6. Non-volatile memory or self-charging battery circuit.
7. Complete shutoff capability for total cessation of outdoor irrigation.
8. Plastic wall-mount enclosure.
9. Shall be prewired for remote control.
10. The controller shall be furnished in a wall-mount plastic enclosure, pre-wired for remote control, with a key lock.
11. The controller shall provide modular expansion up to 30 stations conventionally wired, or 48 stations via two-wire decoders.
12. The enclosure shall be IP44 rated.
13. A 751CH key shall be mounted in the enclosure door for security.
14. Two (2) keys shall be provided per each controller.

2.6 SENSORS

A. Weather Sensors: Equip irrigation systems with rain sensors.

1. The rain sensor shall be capable of interrupting the power from the irrigation controller to the valves when rainfall exceeds a pre-selected amount.
2. The rain sensor circuitry shall be housed in an UV and corrosion resistant plastic casing and shall utilize 2 sets of hygroscopic disks to activate switches in the unit. One switch will be for the total rainfall compensation unit and the other for the Quick Response™ unit. The Quick Response™ unit will turn off the irrigation system within 5 minutes of the onset of precipitation, depending on the intensity.
3. The sensor shall be adjustable by turning a plastic collar on the device that regulates an opening, thus varying the rate of evaporation from the disks.
4. The sensor shall have an integral, adjustable, aluminum, mounting bracket that allows installation on angled, as well as perpendicular surfaces. The sensor shall have a mounting option that allows for installation on a rain gutter.
5. The sensor shall be installed in accordance with the manufacturer's published instructions. The sensor shall carry a conditional five-year exchange warranty. The rain sensor shall be the MWS-FR Mini-Weather Station series as manufactured by Hunter Industries Incorporated, San Marcos, California.

2.7 METERS

- ### A.
- Provide an irrigation deduct meter to measure the amount of water applied to the landscape.

PART 3 - EXECUTION

3.1 LEED

- #### A.
- Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:

1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 PIPE LAYING - GENERAL

- A. Do not lay pipe on unstable material, in wet trench or when, in the opinion of Owner's Representative, trench or weather conditions are unsuitable for the work.
- B. Concrete thrust block shall be installed where the irrigation main changes direction as at elbows and tees and where the irrigation main terminates. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.
- C. Allow a minimum of 80 mm (3 inches) between parallel pipes in the same trench.
- D. Hold pipe securely in place while joint is being made.
- E. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- F. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- G. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- H. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
- I. Minimum cover over water mains shall be 750 mm (24 inches). Control valves shall never be less than 80 mm (3 inches) below finished grade. Cover laterals to minimum depth of 600mm (18 inches).
- J. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the warranty period.
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials, and equipment.
- L. Warning tape shall be continuously placed 300 mm (12 inches) above sprinkler system water mains and laterals.

3.3 LAYING PLASTIC AND PVC PIPE

- A. Shall be snaked in trench at least 1 meter per 100 meters (1 foot per 100 feet) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints

1. Solvent Welded Socket Type: ASTM D2855.
2. Threaded Type: Apply liquid Teflon thread lubricant of Teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to two additional full turns.
3. Elastomeric Gasket: ASTM F477.
 - a. Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot and the elastomeric gasket shall be thoroughly cleaned to remove all foreign material.
 - b. Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications.
 - c. Care shall be taken that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell or coupling shall be in accordance with the manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full depth of the joint.
 - d. The spigot and bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.

3.4 INSTALLATION OF SPRINKLERS AND QUICK COUPLERS

- A. Sprinkler heads and quick couplers shall be placed on temporary nipples extending at least 80 mm (3 inches) above finished grade. After turf is established, remove temporary nipples, ensuring that no dirt or foreign matter enters outlet, and install sprinkler heads and quick couplers at ground surface as detailed.
- B. Install all shrub sprays, sprinklers and quick couplers on swing joints as detailed on plans.
- C. Set shrub heads adjacent to edge of curb, pavement, or plant bed edge. Place adjacent to walls. Stake heads prior to backfilling trenches. Stakes to be parallel to riser.
- D. Install sprinklers and quick coupling valves on a swing joint assembly.

3.5 INSTALLATION OF CONTROLLER AND RECEIVER

- A. Install Independent Controller in Mechanical Room.
 1. Confirm location with Owner's Representative prior to installation.
- B. Install Weather Sensor Receiver in stairway adjacent to Mechanical Room.
 1. Confirm that Receiver is receiving signals from the existing weather sensor on the parking structure prior to installation.
 2. Confirm Receiver location with Owner's Representative prior to installation
 3. Install Receiver in locking plastic enclosure mounted on wall.
 4. Connect Receiver to Independent Controller

3.6 INSTALLATION OF CONTROL WIRING

- A. Interior wiring shall be installed in concealed conduit hidden from view by building finishes. See electrical or communications plans for conduit routing.
- B. Seal all penetrations where conduit passes through building walls.
- C. Exterior wiring from controllers to valves shall be located in trench with new mains or in separate trench at back of curb or along pavement unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.
 - 1. Verify location of existing utilities and irrigation prior to trenching.
 - 2. If trenching passes through existing plant beds, restore landscape disturbed by construction.
- D. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.
- E. Splicing shall be held to a minimum. A pull box shall be provided at each splice. No splices will be allowed between field located controllers and remote-control valves.
- F. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
- G. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

3.7 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.
- B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a Dymo-Tape type plastic label with designation "Tracer Wire."
- C. Record locations of tracer wires and their terminations on project record documents.

3.8 SETTING OF VALVES

- A. No valves shall be set under roads, pavement, or walks.
- B. Clean interior of valves of foreign matter before installation.
- C. Where pressure control valves are installed adjacent to remote control valve, they shall be housed in the same valve box.
- D. Set valve box cover flush with finished grade.

3.9 SLEEVING

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other

similar areas.

- B. Sleeving under pavement to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 300 mm (12 inches) beyond edges of paving or construction.

- 1. Bed sleeves with a minimum of 100 mm (4 inches) of sand backfill above top of pipe.

- C. Sleeving through planter walls to be minimum size required to accommodate pipe and wiring.

3.10 TEST AND FLUSHING

- A. Pressure Test: Pressure test lines before joint areas are backfilled. Backfill a minimum of 300 mm (12 inches) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 1025 kPa (150 psi) for two hours. Maximum loss shall be 3 L/25 mm pipe diameter/300 m (0.8 gallons/inch pipe diameter/1000-feet). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.
- B. Flushing: After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.
- C. Operation Test: Upon completion of the final adjustment of the sprinkler heads to permanent level at ground surface, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate the entire installation to demonstrate the complete and successful operation of all equipment.

3.11 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 329100 – PLANTING SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation, and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
 - 1. Harvest and stockpile existing site soils suitable for Planting Soil.
 - 2. Modify existing stockpiled site soil.
 - 3. Modify existing site soil in place for use as Planting Soil.
 - 4. Install existing or modified existing soil for use as Planting Soil.
 - 5. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
 - 6. Fine grade Planting Soil.
 - 7. Install Compost into Planting Soil.
 - 8. Clean up and disposal of all excess and surplus material.

1.02 CONTRACT DOCUMENTS

- A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.03 RELATED DOCUMENTS AND REFERENCES

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.
 - 1. Section - Planting
 - 2. Section - Irrigation
 - 3. Section – Tree and Plant Protection
 - 4. ASTM: American Society of Testing Materials cited section numbers.
 - 5. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.
 - 6. US Composting Council www.compostingcouncil.org and http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf.
 - 7. Methods of Soil Analysis, as published by the Soil Science Society of America (<http://www.soils.org/>).
 - 8. Up by Roots: healthy soils and trees in the built environment. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.

1.04 VERIFICATION

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.

1.05 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply, or Owner's Representative shall determine which shall govern.

1.06 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.07 CHANGES IN WORK

- A. The Owner's Representative may order changes in the work, and the contract sum adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications, and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.08 CORRECTION OF WORK

- A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands but not more than 180 (one hundred and eighty) days after notification.

1.09 DEFINITIONS

- A. **Acceptable drainage:** Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between 1 - 5 inches per hour. In natural undisturbed soil a much lower drainage rate, as low as 1/8th inch per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers but could become unstable in high wind events.
- B. **Amendment:** material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.
- C. **Biological Amendment:** Amendments such as Mycorrhizal additives, compost tea or other

products intended to change the soil biology.

- D. **Compacted soil:** soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.
- E. **Compost:** well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.
- F. **Drainage:** The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).
- G. **End of Warranty Acceptance:** The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.
- H. **Existing soil:** Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.
- I. **Fertilizer:** amendment used for the purpose of adjusting soil nutrient composition and balance.
- J. **Fine grading:** The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes or other suitable devices, and further defined in this specification, and further defined in this specification.
- K. **Finished grade:** surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.
- L. **Graded soil:** Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.
- M. **Installed soil:** Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.
- N. **Minor disturbance:** Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top 6 inches of the soil, applications of fertilizers, installation of utility pipes smaller than 18 inches in diameter thru the soil zone.
- O. **Owner's Representative:** The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- P. **Ped:** a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.
- Q. **Planting Soil:** Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.
- R. **Poor drainage:** Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is reasonable preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage
- S. **Scarify:** Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.
- T. **Soil Fracturing:** Deep loosening the soil to the depths specified by using a backhoe, and

further defined in this specification.

- U. **Soil Horizons:** as defined in the USDA National Soil Survey Handbook http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_05424Soil
- V. **Ripping:** Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.
- W. **Soil Tilling:** Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, (or spade tiller), and further defined in this specification.
- X. **Soil trenching:** Cutting narrow trenches thru the soil at the depths and spacing specified to loosen the soil profile, and further defined in this specification.
- Y. **Subgrade:** surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
- Z. **Substantial Completion Acceptance:** The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.
- AA. **Topsoil:** naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.
- BB. **Undisturbed soil:** Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire, or logged but not graded, and natural forested land will be considered as undisturbed.

1.10 SUBMITTALS

- A. See the contract General Conditions for policy and procedures related to submittals.
- B. Submit all product submittals four weeks prior to the start of the soil work.
- C. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:
- D. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.
 - 1. For each Compost product submit the following analysis by a recognized laboratory:
 - a. pH
 - b. Salt concentration (electrical conductivity)
 - c. Moisture content %, wet weight basis
 - d. Particle size % passing a selected mesh size, dry weight basis
 - e. Stability carbon dioxide evolution rate mg CO₂-C per g OM per day
 - f. Solvita maturity test
 - g. Physical contaminants (inerts) %, dry weight basis
 - h. US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)
 - 2. For Coarse Sand product submit the following analysis by a recognized laboratory:
 - a. pH
 - b. Particle size distribution (percent passing the following sieve sizes):
 - 3/8 inch (9.5 mm)
 - No 4 (4.75 mm)
 - No 8 (2.36 mm)

No 16(1.18 mm)
No 30 (.60 mm)
No 50 (.30 mm)
No 100 (.15 mm)
No 200 (.075 mm)

3. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.
 - a. Submit samples a minimum of 8 weeks prior to the anticipated date of the start of soil installation.
 - b. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.
4. Soil testing for Imported and Existing Topsoil, existing site soil to be modified as Planting Soil and Planting Soil Mixes.
5. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
 - a. Submit Topsoil, Planting Soil, Compost, and Coarse Sand for testing at least 8 weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than 2 weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.
 - b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Owner's Representative.
 - c. All soil testing will be at the expense of the Contractor.
6. Provide the following other soil properties:
 - a. pH and buffer pH.
 - b. Percent organic content by oven dried weight.
 - c. Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
 - d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.
 - e. Cation Exchange Capacity (CEC).

1.11 OBSERVATION OF THE WORK

- A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.
- B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1.12 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

1.13 QUALITY ASSURANCE

- A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section: Planting, shall be the same firm installing the work in this section.
 - 1. The bidders list for work under this section shall be approved by the Owner's Representative.
 - 2. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the Owner's Representative.
 - 3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Owner's Representative.
 - 4. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).
 - 5. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.
- B. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.
- C. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.
 - 1. The Owner's Representative may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.
 - 2. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.
 - 3. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.
 - 4. Any Planting Soil that fails to meet the above criteria, if requested by the Owner's Representative, shall be removed and new soil installed.
- D. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.
 - 1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
 - a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or approved equal.
 - b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or approved equal.

- E. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
- F. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

1.14 SITE CONDITIONS

- A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, they shall remain responsible for plant material under the warrantee clause of the specifications.
- C. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

1.15 SOIL COMPACTION – GENERAL REQUIREMENTS

- A. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.
 - 1. Penetration Resistance Method
 - a. Units – PSI (lb. pressure per sq. in.) Threshold results that determine critical bulk density are somewhat the same for each soil texture.
 - b. Measurement tool - Penetrometer
- B. The following are threshold levels of compaction as determined by each method.
 - 1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.
 - a. Penetration Resistance Method – about 300 psi.
 - 2. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
 - a. Penetration Resistance Method – Approximately above 400 psi

1.16 DELIVERY, STORAGE, AND HANDLING

- A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.
- B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.
- C. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and

heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.

- D. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.
- E. Bulk material: Coordinate delivery and storage with Owner's Representative and confine materials to neat piles in areas acceptable to Owner's Representative.

1.17 EXCAVATING AND GRADING AROUND UTILITIES

- A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of the Mason county PUD No. E, (360) 426-8255, is required for all planting areas. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the Mason county PUD No. E.

PART 2 - PRODUCTS

2.01 COMPOST

- A. Compost: Blended and ground leaf, wood and other plant-based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure-based material designed to produce Compost high in fungal material.
 - 1. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component". http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf
 - 2. Compost shall comply with the following parameters:
 - a. pH: 5.5 - 8.0.
 - b. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).
 - c. Moisture content %, wet weight basis: 30 – 60.
 - d. Particle size, dry weight basis: 98% pass through 3/4-inch screen or smear.
 - e. Stability carbon dioxide evolution rate: mg CO₂-C/ g OM/ day < 2.
 - f. Solvita maturity test: > 6.
 - g. Physical contaminants (inerts), %, dry weight basis: <1%.
 - h. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.
 - i. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.
- B. Provide a two-gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.02 COARSE SAND

- A. Clean, washed, sand, free of toxic materials
 - 1. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8

and 3.2.

2. Coarse Sands shall be clean, sharp, natural Coarse Sands free of limestone, shale, and slate particles. Manufactured Coarse Sand shall not be permitted.
3. pH shall be lower than 7.0.
4. Provide Coarse Sand with the following particle size distribution:

<u>Sieve</u>	<u>Percent passing</u>
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-60
No 50 (.30 mm)	10-30
No 100 (.15 mm)	2-10
No 200 (0.75 mm)	2-5

- B. Provide a two-gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.03 EXISTING SOIL (ACCEPTABLE FOR PLANTING WITH MINIMUM MODIFICATIONS)

- A. Undisturbed soil or soil with minor disturbance to soil profiles (e.g., farming) has at least two of the following attributes:
 1. Site soils not excessively graded or not compacted at root limiting or above.
 2. Soils previously disturbed have a restored A horizon (min 2.5% organic matter dry weight) at least 6 inches deep and B and/or C horizons that drain and have acceptable compaction.
 3. Soils are currently supporting mature tree and or large shrub growth with high vitality.
 4. Sufficient soil volumes meeting the above criteria above rock or other limiting structures to support the proposed plants.
- B. General definition of existing soil: Surface soil in the areas designated on the soils plan as existing soil, that is not altered, compacted to root limiting density, graded or contaminated before or during the construction process and considered acceptable for planting and long-term health of the plants specified either as it exists or with only minor modification.
 1. The Owner's Representative shall verify that the soil in the designated areas is suitable at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for use as Planting Soil to the point where the soil is no longer suitable to support the plants specified, the Owner's Representative may require modification of the damaged soil up to and including removal and replacement with soil of equal quality to the soil that existed prior to construction. Examples of damage include further compaction, contamination, grading, creation of hard pan or drainage problems, and loss of the O, and or A horizon.
 2. Do not begin work on additional modifications until changes to the contract price are approved by Owner's Representative.
- C. Protect existing soil from compaction, contamination, and degradation during the construction process.
- D. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not increase compaction of soil to root limiting levels.

- E. Remove existing turf thatch, ground cover plants and weeds.
- F. Modified Existing Soil (SOIL Suitable for planting with indicated modification)
 - 1. General definition: Surface soil in the areas designated on the soils plan as Modified Existing Soil has been altered and or graded before or during the construction process but is still considered acceptable for planting and long-term health of the plants specified with the proposed modifications. Modifications respond to the soil problems expected or encountered. The Owner's Representative shall verify that the soil in the designated areas is suitable for modification at the beginning of planting bed preparation work in that area.
 - 2. The Owner's Representative shall verify that the soil in the designated areas is suitable for the specified modification at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for modification to the point where the soil is no longer suitable to support the plants specified with the specified modification, the Owner's Representative may require further modification of the damaged soil up to an including removal and replacement with soil of equal quality to the soil that would have resulted from the modification. Damage may include further compaction, contamination, grading, creation of hard pan or drainage problem, and loss of the O, and or A horizon.
 - 3. General requirements for all soil modifications:
 - a. Take soil samples, test for chemical properties, and make appropriate adjustments.
 - b. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not add to the compaction in the soil.
 - c. All soil grading, tilling and loosening must be completed at times when the soil moisture is below field capacity. Allow soil to drain for at least two days after any rain event more than 1 inch in 24 hours, or long enough so that the soil does not make the hand muddy when squeezed.
 - d. Provide pre-emergent weed control after the soil work is complete and plants planted but prior to adding mulch to the surface, if indicated by weed type and degree of threat.
- G. Modified existing soil – soil removed, stockpiled, and spread
 - 1. Description of condition to be modified: Existing soil that is suitable for reuse as Planting Soil but is in the wrong place of elevation or cannot be adequately protected during construction. Soil is to be harvested, stockpiled and re-spread with or without further modifications as indicated.
 - 2. Excavate existing soil from the areas and to depths designated on the drawings. Stockpile in zones noted on the drawings or in areas proposed by the Contractor.
 - a. See detail 1 on sheet L003.
 - 3. Prepare a soil stockpile plan for approval.
 - 4. Excavate soil using equipment and methods to preserve the clumps and peds in the soil. Generally, this means using the largest piece of equipment that is practical for the project size and scope.
 - 5. Protect stockpiles from erosion by compacting or tracking the soil surface, covering with breathable fabric or planting with annual grasses as appropriate for the season, location, and length of expected time of storage.
 - 6. Following soil ripping the average penetration resistance should be less than 250 psi

to the depth of the ripping or fracturing.

7. Do not start planting into ripped or fractured soil until soil has been settled or leave grades sufficiently high to anticipate settlement of 10 – 15% of ripped soil depth.
- H. Modified existing soil – soil within the root zone of existing established trees
 1. Do not disturb soils within the CRZ of existing trees.
 2. Add a maximum of 2" topsoil.

2.04 PLANTING SOIL MIXES

- A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and or Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite, and will vary in Mix components and proportions as indicated.

- B. Planting Mix - moderately slow draining soil for trees and shrub beds

1. A Mix of Imported Topsoil, Coarse Sand and Compost. The approximate Mix ratio shall be:

<u>Mix component</u>	<u>% by moist volume</u>
Imported Topsoil unscreened	45-50%
Coarse sand	40-45%
Compost	10%

2. Final tested organic matter between 2.75 and 4% (by dry weight).
3. Mix the Coarse Sand and Compost together first and then add to the Topsoil. Mix with a loader bucket to loosely incorporate the Topsoil into the Coarse Sand/Compost Mix. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.
4. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.
5. Provide a two-gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time.

PART 3 - EXECUTION

3.01 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.

3.02 SITE EXAMINATION

- A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.
 1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under-drain lines as shown on the drawings.
 2. Confirm that surface all areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches

diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.

3. Confirm that no adverse drainage conditions are present.
 4. Confirm that no conditions are present which are detrimental to plant growth.
 5. Confirm that utility work has been completed per the drawings.
 6. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.
- B. If unsatisfactory conditions are encountered, notify the Owner's Representative immediately to determine corrective action before proceeding.

3.03 COORDINATION WITH PROJECT WORK

- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
- B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
- C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.04 GRADE AND ELEVATION CONTROL

- A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

3.05 SITE PREPARATION

- A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.
- B. Remove all construction debris and material including any construction materials from the subgrade.
- C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
- D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.
- E. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2-inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
- F. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
- G. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.06 SOIL MOISTURE

- A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.07 EXISTING SOIL MODIFICATION

- A. Follow the requirements for modifying existing soil as indicated in Part 2 for the different types of soil modifications. The extent of the areas of different soil modification types are indicated on the Soils Plan or as directed by the Owner's Representative.

3.08 PLANTING SOIL AND PLANTING SOIL MIX INSTALLATION

- A. Prior to installing any Planting Soil from stockpiles or Planting Soil Mixes blended off site, the Owner's Representative shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.
- B. All equipment utilized to install, or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6-inch-long teeth to scarify any soil that becomes compacted.
- C. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.
1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the backhoe or loader bucket, tiller or another suitable device.
 2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
 3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.
- D. Install the Planting Soil in 12 to 18-inch lifts to the required depths. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.
- E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.
- F. Note to specifier: The following 4 paragraphs are not normal to most soil installation specifications but are deemed critical to the process. Be sure that the Owner's Representative is familiar with these requirements during construction observation.

- G. Where possible place large trees first and fill Planting Soil around the root ball.
- H. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown cause by this type of equipment.
- I. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" (section 3.9) in the event that soil becomes over compacted.
- J. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, mulch, or sod.

3.09 COMPACTION REQUIREMENTS FOR INSTALLED OR MODIFIED PLANTING SOIL

- A. Compact installed Planting Soil to the compaction rates indicated and using the methods approved for the soil mockup. Compact each soil lift as the soil is installed.
- B. Existing soil that is modified by tilling, ripping, or fracturing shall have a density to the depth of the modification, after completion of the loosening, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilting point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.
- C. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilt point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.
- D. Planting Soil compaction shall be tested at each lift using a penetrometer calibrated to the mockup soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.
- E. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.
- F. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction used to construct the Planting Soil mockup.
- G. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.
 - 1. Light weight equipment such as trenching machines or motorized wheelbarrows is permitted to pass over finished soil work.
 - 2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.10 OVER COMPACTION REDUCTION

- A. Any soil that becomes compacted to a density greater than the specified density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes

compaction caused by other sub-contractors after the Planting Soil is installed and approved.

- B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.11 INSTALLATION OF CHEMICAL ADDITIVES

- A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.
- B. Types, application rates and methods of application shall be approved by the Owner's Representative prior to any applications.

3.12 FINE GRADING

- A. The Owner's Representative shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.
- B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 – 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.
- C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.
- D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall, and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.
- E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.
- F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2-inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1-inch deviation from the plane in 10 feet.

3.13 INSTALLATION OF COMPOST TILL LAYER

- A. After Planting Soil Mixes are installed in planting bed areas and just prior to the installation of shrub or groundcover plantings, spread 3 – 4 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in paragraph "Fine Grading". This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph "Planting Soil and Planting Soil Mix installation" must still be accounted for in the setting of final grades.

3.14 CLEAN-UP

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash, or debris deposited by

the Contractor from all surfaces within the project or on public right of ways and neighboring property.

- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative seals are to remain on the trees and removed at the end of the warranty period.
 - 1. Make all repairs to grades, ruts, and damage to the work or other work at the site.
 - 2. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.15 PLANTING SOIL AND MODIFIED EXISTING SOIL PROTECTION

- A. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.
- B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Owner's Representative. Planting Soil shall be loosened or replaced at no expense to the Owner.
 - 1. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.
 - 2. Where modified existing soil has become contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

3.16 PROTECTION DURING CONSTRUCTION

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.
- B. Maintain protection during installation until the date of plant acceptance (see specifications section – Planting). Treat, repair, or replace damaged work immediately.
- C. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings, or turf.
- D. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.17 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.
- B. The date of substantial completion of the planting soil shall be the date when the Owner's Representative accepts that all work in Planting and Planting Soil installation sections is complete.

3.18 FINAL ACCEPTANCE / SOIL SETTLEMENT

- A. At the end of the plant warrantee and maintenance period, (see Specification section - Planting) the Owner's Representative shall observe the soil installation work and establish that all provisions of the contract are complete, and the work is satisfactory.
- B. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.
- C. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

END OF SECTION 32 9100

SECTION 32 91 15 – BOULDERS AND SITE STONE

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope of Work: Work includes furnishing and installing boulders, river rock, pebbles, and gravel.

1.2 RELATED SECTIONS

- A. Coordinate related work specified in other parts of the Contract Documents, including but not limited to the following:

Section 31 20 00 – Earth Moving

Section 32 91 13 – Soil Preparation

1.3 SUBMITTALS

- A. Sample Demonstration: Provide mock-up of rock work to demonstrate and secure approval of rock placement skills. Prepare a sample 10' X 10' rock installation to include large and small boulders, river rock. Owner's Representative shall select location for mock-up.

1.4 LEED SUBMITTALS

- A. For components of this section submit the following in compliance with section 01 35 15 - LEED certification procedures.

- 1. LEED Submittal Coversheet

- 2. Materials and Resources Submittals:

- a. MR Credit BBPDO - Sourcing Of Raw Materials: manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with section 01 35 15 – LEED certification procedures.

- 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.5 QUALITY ASSURANCE

- A. Selection and placement of the boulders and other stone shall require oversight by the Owner's Representative in the field.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store materials for pools so that it is protected from contamination by soil or other materials.

- B. Coordinate storage/stockpile of materials on the site where they will not interfere with other construction work.

PART 2 - PRODUCTS

2.1 SUPPLIER

- A. Approved Supplier: Walker Developments Landscape Supply, or approved equal

cdirtwalker@yahoo.com
360-740-7445
1951 North National Avenue,
Chehalis, WA 98532

2.2 GRANITE BOULDERS

- A. All Weathered High Cascade granite boulders shall be selected by the Owner's Representative from Marenako's Rock Center, Issaquah, WA, or as approved.
- B. Rock shall be rounded and sized as indicated on Drawings.
- C. Granite stone collected on site from excavation and earthwork may be used, subject to inspection by the Owner's Representative.
- D. Rock material shall be selected pieces of rock sound and resistant to weathering. Boulders in landscape areas may be angular or rounded. Boulders and other rock at pools shall be rounded. Rock shall be free of soft, weathered material and seams of soft rock susceptible to deterioration.
- E. The density of rock material shall be a minimum of 160 pounds per cubic foot. The size categories of rock shall be as follows:

<u>SIZE</u>	<u>APPROX. WEIGHT</u>	<u>MIN. DIMENSION</u>	<u>APPROX. VOLUME</u>
One -man rock	160 to 400 lb	12 inches	1.75 cf
Two-man rock	500 to 800 lb	13 inches	4.00 cf
Three-man rock	800 to 1,200 lb	16 inches	6.60 cf
Four-man rock	1,200 to 1,600 lb	18 inches	9.00 cf
Larger sizes	1,600 lb & larger	24 inches & greater	12 cf & greater

2.3 GRANITE RIVER ROCK

- A. Material: Cascade foothills
 - 1. Product name: Fish Rock,
 - b. Size: ¾" to 10"
 - c. Percent of mix: 50%

2. Product name: River Rock
 - a. Size: 5"-10"
 - b. Percent of mix: 50%

2.4 CRUSHED ROCK BASE COURSE FOR PATH

- A. Type 1 Mineral Aggregate (3/4" minus crushed rock), bearing no naturally occurring or worn surfaces.

2.5 CRUSHED ROCK TOP COURSE FOR PATH

- A. 3/8" Minus Crushed Rock shall consist of crushed ledge rock or talus bearing no naturally occurring or worn surfaces.
- B. Graduation of the top course shall be:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8" square sieve	100
No. 4 sieve	95 - 100
No. 8 sieve	75 - 80
No. 16 sieve	55 - 65
No. 30 sieve	40 - 50
No. 50 sieve	25 - 35
No. 100 sieve	20 - 25
No. 200 sieve	5 - 15

2.6 METAL EDGING (add/alt)

- A. Steel Pathway Edging shall be an all-steel interlocking system, 3/16" to 1/4" thick, and 4" to 6" min. depth, in 16 to 20' long sections with 6 steel stakes per section, having a black powder coated finish. Supply adequate stakes for each section to be installed. Stakes shall be 15" long steel construction. Steel Pathway Edging as manufactured by Sure-loc Edging Corporation, 494 E. 64th Street, Holland, MI, 49423, Ph: 1 800 787-3562; Border Concepts, P.O. Box 471185, Charlotte, NC, 28247, Ph: 704 541-5509; Collier Metal Specialties, Inc., Dallas Texas, Ph: 1 800 829-8225; or approved equal.

PART 3 - EXECUTION

3.1 LEED

- A. Refer to section 01 35 15, LEED certification procedures for additional information relating to execution of the following LEED credits:
 1. Sustainable Sites – Construction Activity Pollution Prevention: comply with provisions of 01 57 13 Temporary Erosion And Sedimentation Controls.
 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 GENERAL

- A. All material shall be handled using equipment and machinery appropriate for protecting the stones from cracking, chipping, and dents. Equipment operators shall be skilled and experienced with placement of large stones.

- B. Prior to commencing rock work, Contractor shall prepare sample demonstration area per 1.3.A and receive written approval of sample by Owner's Representative.
- C. All subgrades before placement of stone shall be compacted to 95 percent density. Contractor shall be responsible for any settlement of rocks and/or rock walls, and any resultant damages.

3.3 PLACEMENT OF BOULDERS IN LANDSCAPE

- A. All boulders shall be placed by the Contractor as directed by the Owner's Representative. Locations shown on the Drawings are approximate. Placement and orientation of each boulder shall be as directed by the Owner's Representative on-site. Notify Owner's Representative 72 hours in advance of boulder placement activity.
- B. Boulders shall be installed on minimum 6 inches depth of compacted crushed rock over compacted subgrade. Boulders shall have from $\frac{1}{4}$ up to $\frac{1}{2}$ the total height set below the finished grade.

3.4 CRUSHED ROCK PATH

Install as indicated on Drawings.

3.5 METAL EDGING

- A. Install as indicated on drawings and as recommended by manufacturer under the condition specified. The metal edging is to be used in the condition of the "Crushed Rock Path" as shown on the drawings. Edging is required only at the path west of the building.

3.6 CLEANING

- A. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION

SECTION 32 93 00 – PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Scope of Work: The work includes furnishing and installation of trees, shrubs, and ground covers.

1.2 RELATED SECTIONS

- A. Coordinate related work specified in other parts of the Contract Documents, including but not limited to the following:

Section 02231 = Tree Protection
Section 32 91 13 - Soil Preparation

1.3 QUALITY ASSURANCE

- A. General:

1. All plant material shall be nursery grown under climate conditions similar to or hardier than at the site and meet or exceed applicable American Association of Nurserymen (AAN) Standards.
2. Plants shall be of normal habit of growth, healthy, vigorous, and free of disease, insects, insect eggs and larva.
3. Measurements shall be taken with all branches in their normal growing position.
4. Prune no plants prior to delivery to site.
5. Trees shall not be broken nor bark bruised, cut, or removed in any manner.

- B. Standards:

1. Measurements, caliper, branching, grading, quality, balling and burlapping shall follow the American National Standards as defined by the American Association of Nurserymen in the American Standard for Nursery Stock (ASNS), ANSI Z60.1-1996, latest edition.

1.4 SUBMITTALS

- A. Plant Materials:

1. Plant Procurement:

- a. Within 60 days of the Notice to Proceed, verify all sources of supply to insure that all plants of the species, size and quality specified are available. It is the Contractor's responsibility to locate plant materials.
- b. Submit samples of all plant material to the Landscape Architect for acceptance prior to shipment to site. Color photographs may be acceptable.
- c. When requested by the Landscape Architect, produce sale receipts for nursery stock and certificates of inspection from required authorities.

2. Planting Quantity: Total number of plants shall be as indicated on planting plan. If this total differs from the plant legend, notify the Landscape Architect before bid date. The plan takes precedence over the specification for total plant quantity.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. All plant material shall be transported to planting locations with care to prevent damage. Tie back branches as necessary and protect bark from chafing with burlap bags. Do not drag plant material along ground without proper protection of roots and branches.
- B. If planting is delayed more than 24 hours after delivery, set balled and burlapped plants on the ground, well protected with soil or wet peat. Adequately cover all roots of bare root material with soil or wet peat. Protect root balls from freezing, sun, drying winds or mechanical damage. Water as necessary until planted. Do not heel in plants for more than one (1) week.
- C. Special Handling of Trees Three (3) Inch Caliper and Larger:
 - 1. Lift all trees by rootball only. Secure on pallet as necessary to avoid breaking root ball.
 - 2. No bark scars will be accepted. Protect bark from cables and lines with burlap cover or rubber mat. Tie back branches as necessary to avoid breakage during installation.

1.6 PROJECT/SITE CONDITIONS

- A. Planting Time:
 - 1. Do not install plants when ambient temperatures may drop below 35 degrees F or climb above 80 degrees F.
 - 2. Do not install plants when wind velocity exceeds 30 MPH.
 - 3. Bareroot Stock: Plant bareroot stock from October to February only.
 - 4. Balled and Burlapped Stock: Plant during periods which are normal for such work, as determined by season, weather conditions and accepted practice.
 - 5. Do not plant when ground is frozen or excessively wet.
- B. Disposal of Waste Materials:
 - 1. Remove all plastic labels, materials, and synthetic burlap from planting pit, after plant is in place. Remove from site.

1.7 WARRANTY

- A. Warrant plant material to remain alive and be in healthy, vigorous condition for a period of one (1) year after completion and acceptance of entire project. Inspection of plants will be made by the Owner's Representative at completion of planting.
- B. Replace, in accordance with the drawings and specifications, all plants that are dead or, as determined by the Owner's Representative, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence. The cost of such replacement(s) is at the Contractor's expense. Warrant all replacement plants for one (1) year after installation, unless otherwise specified.
- C. Warranty shall not include damage or loss of trees, plants or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 75 MPH, winter kill caused by extreme cold and severe winter conditions not typical of planting area: acts of vandalism or negligence on the part of the Owner.
- D. Remove and immediately replace all plants, as determined by the Owner's Representative, to be unsatisfactory during the initial planting installation.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. Trees and Shrubs:

1. Trees: Straight trunks with leader intact, undamaged and uncut. Rootball diameter shall be in accordance with ASNS.

Plant materials shall be sound, healthy and vigorous; well-branched and densely foliated when in leaf; free from disease, insect pests, eggs or larva and with healthy, well developed root systems.

B. Balled and Burlapped Stock:

1. Dig with firm, natural, balls of earth of sufficient diameter and depth to encompass fibrous and feeding root system.
2. Wrap root balls firmly with burlap and bind with twine or wire mesh.

C. Container Stock:

1. Grown in delivery containers for not less than six (6) months but not more than two (2) years.
2. Root bound conditions and broken balls of earth will not be allowed. Do not handle by trunks, stems or tops.

2.2 TREE STAKING MATERIALS

A. Deciduous and Coniferous Trees:

1. Stake trees with two (2) - two (2) inch diameter lodge pole pine stakes (see detail for length). Attach to tree with tie loops, "Chainlock" or approved substitute, 1" width.

2.3 FERTILIZER AND MULCH FOR TREES, SHRUBS AND GROUND COVERS

- A. Fertilizer: Slow release 15-15-15. Acceptable product is Best Endure 15-15-15 or approved equal.
- B. Fertilizer Tablets: Agriform 20-10-5 with trace minerals, or approved equal.
- C. Bark Mulch: Ground Fir or Hemlock bark of uniform color free from weed seeds, sawdust, and splinters. Mulch shall not contain resin, tannin, wood fiber or other compounds detrimental to plant life. Moisture content of bagged mulch not to exceed 22 percent. Size range of 1/2" to 1-1/4" with a maximum of 20 percent passing 1/2" screen.

PART 3 – EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.

3.2 INSPECTION

A. Inspection of Trees and Shrubs:

1. The Landscape Architect shall visit nursery location with the Contractor to select and tag all specimen plant materials. This would include trees over two and one-half (2-1/2) inch in caliper and shrubs over thirty-six (36) inches in height.

2. The Contractor shall locate specimen plant materials and be present for inspection of plants at source. Request the visit at least seven (7) days in advance of the desired inspection date.
3. Inspection and acceptance of all plants, prior to planting, is mandatory and the Landscape Architect reserves the right to reject any or all plant material at any time until final inspection and acceptance.

3.3 PREPARATION

- A. The irrigation system shall be completed and tested prior to planting so that it is capable of keeping the site watered for planting and establishment.

3.4 INSTALLATION

- A. General: Notify the Landscape Architect of all subsurface draining or soil conditions detrimental to growth or survival of plant material.
- B. Trees and Large Shrubs:
 1. Locations of all trees shall be inspected and accepted by the Landscape Architect prior to planting. Indicate the location of each tree with a two (2) inch square by two (2) foot long wood stake or wire stake with flag. Place large containerized or balled and burlapped shrubs in proposed locations for observation by Landscape Architect prior to planting. Begin planting after approval of locations by the Landscape Architect.
 2. Procedure for planting:
 - a. For trees, apply slow-release 15-15-15 fertilizer to backfill at one (1) pound per inch caliper of tree.
 - b. For large shrubs, apply plant tablets at manufacturer's recommended rate for new installations.
 - c. Add native soil to bottom of plant pit and tamp firmly to prevent settlement. Place plant in pit and remove binding of upper one-third of balled and burlapped stock and loosen burlap. Remove all plastic.
 - d. Fill planting pit to two-thirds depth and tamp with foot. Flood holes with sufficient water.
 - e. After surplus water drains off, fill hole to finish grade with backfill and form soil basin around each tree and large shrub. Tamp soil firmly. Stake tree.
- C. Ground Covers, Perennials, and Small Shrubs:
 1. Place plants in containers in perimeter of proposed locations for observation by Landscape Architect prior to planting. An area of approximately 1,000 square feet should be laid out showing a typical configuration. Begin planting after approval of locations by Landscape Architect.
 - a. Clean areas of all extraneous material.
 - b. Apply slow release 15-15-15 fertilizer to amended soil at 20 pounds per 1,000 square feet for ground cover and small shrub areas.
 - c. Dish out plant pockets in staggered rows. Set plants to grade. If on slope, lay plant at angle with slope before backfilling with amended soil.
- D. Mulching:
 1. Cultivate soil to remove all existing weeds and grass. Apply two (2) inch layer of bark mulch throughout planting beds, and in a minimum three (3) foot radius circle around trunk of each tree.
- E. Staking: Stake all deciduous and coniferous trees immediately after planting.

- F. Pruning: Prune all trees only to remove broken or damaged branches, or for aesthetic purposes as directed by the Owner's Representative. Branches will be pruned at the branch collar. Neither stubs nor flush cuts will be acceptable.
- G. Edging: The metal edging is to be used in the condition of the "Gravel Surfacing Path" as shown on the drawings. Edging shall be installed per manufacturer's recommendations under the condition specified.

3.5 MAINTENANCE

- A. Maintain planting in a healthy growing condition acceptable to the Owner's Representative for a minimum of 90 days after Final Acceptance.
- B. Maintenance shall include cultivating, weeding, watering, and pruning (only as directed). Application of herbicides, pre-emergent herbicides, insecticides, or other toxic substances are not allowed for general weed and pest control. Use integrated pest management practices (IPM), using least toxic methods of control. If it is determined by a horticultural expert that disease or pest control chemicals are needed, secure Owner's written approval before application.
 - 1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.
 - 2. Straighten, repair and adjust guy wires and stakes as required.
 - 3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.
 - 4. Water trees, plants and ground cover beds within the first twenty-four (24) hours of initial planting, and not less than twice per week until final acceptance.

3.6 FINAL ACCEPTANCE

- A. Inspection to determine final acceptance of planted areas will be made by the Owner's Representative, upon Contractor's request. Provide notification at least ten (7) working days before requested inspection dates. Complete all work before requesting inspection.
 - 1. Owner's Representative will prepare a punch list of items to be completed if necessary.
 - 2. Final acceptance will be granted in writing after completion of punch listed items. Planted areas will be accepted provided all requirements have been complied with and plant materials are alive and in a healthy, vigorous condition.
- B. Upon Final Acceptance, the landscape maintenance contract per Section 32 90 00 shall commence.

3.7 GUARANTEE PERIOD

- A. Duration of Guarantee:
 - 1. Plant materials shall be guaranteed for a period of one (1) year from the date of final acceptance. Final acceptance constitutes the beginning of the one-year warranty period for that segment of work.
 - 2. Replace defective plant materials noted and upon completion of replacements, final approval of all guaranteed plants will be verified in writing by the Landscape Architect.

END OF SECTION

SECTION 33 11 00 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes:
 - 1. Waterlines
 - 2. Domestic water meters
 - 3. Valves
 - 4. Fire hydrants
 - 5. Various appurtenances

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections, and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to Section 7-09.2 of the WSDOT Standard Specifications for water mains and Section 7-15.2 for service connections.
- B. Water main pipe shall be PVC conforming to Section 9-30.1(5) of the WSDOT Standard Specifications unless otherwise noted on the plans.
- C. Domestic water and fire service pipes over 2-inches shall be PVC conforming to Section 9-30.1(5) of the WSDOT Standard Specifications unless otherwise noted on the plans.
- D. Domestic water service pipe 2-inches and under shall be copper tubing in conformance with Section 9-30.6(3)A of the WSDOT Standard Specifications.

2.2 VALVES

- A. Valves shall be gate valves conforming to Section 7-12.2 of the WSDOT Standard Specifications. Valve boxes shall be installed on all valves.

2.3 FIRE HYDRANTS

- A. Fire hydrants shall conform to Section 7-14.2 of the WSDOT Standard Specifications.

2.4 POST-INDICATOR VALVE

- A. Post Indicator Valve (PIV) shall be UL listed and FM approved. Indicator post shall be round, full length, adjustable cast iron body mounted over a non-rising stem gate valve. Height of control nut for PIV shall be 36 to 42 inches above finished grade. A 36-inch minimum clear radius to any obstruction shall be provided.

2.5 DOMESTIC WATER METER

- A. Meter setter shall be as shown on the contract plans.
- B. Water meter shall be a Type 1 electromagnetic or ultrasonic flow meter conforming to AWWA C715-18 compatible with meter setter shown on contract plans. Meter shall have a digital meter head compatible with BACNet direct digital control (DDC) systems. The meter shall provide a fully potted wire connection for use with DDC systems.
- C. Water meter shall have distinguishing markings including the manufacturer's name, flow direction, nominal size, and maximum working pressure.
- D. Water meter shall not require a strainer for accurate operation.
- E. Water meter manufacturer shall be a member of AWWA with a minimum of twenty-five (25) years of field and production experience in water measurement technologies and serving water utilities in the United States.
- F. All components shall be sound and free from all defects and shall be constructed to a high standard of workmanship. Meter manufacturer shall meet or exceed AWWA C715 accuracy standards and warrant their published accuracy levels for the life of their meters. Each meter shipment must be accompanied by factory test data showing the accuracy of the meter as tested at their factory.

2.6 CONCRETE

- A. Unreinforced concrete shall be commercial class conforming to Section 6-02.3(2)B of the WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 TRENCHES

- A. Trenches shall be excavated and backfilled, and the pipe shall be bedded in conformance with Section 7-09.3 of the WSDOT Standard Specifications.

3.2 PIPES AND VALVES

- A. Pipes and valves shall be installed in conformance with Section 7-09.3 and 7-12.3 of the WSDOT Standard Specifications.

3.3 SERVICE CONNECTIONS

- A. Service connections shall be installed in conformance with Section 7-15.3 of the WSDOT Standard Specifications.

3.4 FIRE HYDRANTS

- A. Fire hydrants shall be installed in conformance with Section 7-14.3 of the WSDOT Standard Specifications.

3.5 POST INDICATOR VALVE

- A. Post indicator valve shall be installed in conformance with manufacturer's recommendations.

3.6 DOMESTIC WATER METER

- A. Water meter setter shall be installed in conformance with Section 7-15.3 of the WDOT Standard Specifications.
- B. Water meter shall be installed in accordance with manufacturer's recommendations.

3.7 TESTING

- A. Water system shall pressure-tested in conformance with Section 7-09-3(23) of the WSDOT Standard Specifications.

END OF SECTION 33 11 00

SECTION 33 30 00 – SANITARY SEWERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes constructing sanitary side sewers.

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 PIPE

- A. Sewer pipe shall have to conform to Section 7-17.2 of the WSDOT Standard Specifications. All pipe and fittings shall be legibly and permanently marked with type and class.

2.2 CLEANOUTS

- A. Cleanouts shall be of the same material as the pipe and shall conform with Section 7-19.2 of the WSDOT Standard Specifications.

2.3 GREASE INTERCEPTOR

- A. Grease Interceptor shall be as shown on the plans.

2.4 SEPTIC TANK

- A. Septic tank shall be as shown on the plans.

PART 3 - EXECUTION

3.1 PIPE

- A. Pipe shall be installed in conformance with Section 7-17.3 and 7-18.3 of the WSDOT Standard Specifications.

3.2 CLEANOUTS

- A. Cleanouts shall be installed in conformance with Section 7-19.3 of the WSDOT Standard Specifications.

3.3 CLEANING AND TESTING

- A. All sewers and appurtenances shall be cleaned and tested after backfilling by the low pressure air method specified in Section 7-17.3(2) of the WSDOT Standard Specifications.

3.4 GREASE INTERCEPTOR

- A. Grease Interceptor shall be installed in accordance with the manufacturer's recommendations.

3.5 SEPTIC TANK

- A. Septic tank shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION 33 30 00

SECTION 33 32 16 - SANITARY SEWER LIFT STATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes constructing a sanitary sewer lift station with a pre-packaged pumping system.

1.2 STANDARD SPECIFICATIONS

1. All Work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
2. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
3. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 SUBMITTALS

- A. Drawings

1. Submit detailed installation drawings for all lift station components.

- B. Product Data

1. Submit all equipment and product data for review and approval prior to purchase.
2. Provide data on pumps, valves, coatings, control systems, hatches, vents and wet well structure pertaining to the lift station.
3. Approval and Listing: All valves shall be UL listed and FM approved.
4. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- C. Operations and Maintenance Manual

- D. Controls Diagram

1.4 QUALITY ASSURANCE

- A. Qualification of Workers: Employ the services of a qualified utility contractor who will be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this section.

- B. Comply with requirements of the Department of Health.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit project record documents under provisions of Division 01 of the contract specifications and the manufacturer's requirements.
- B. Accurately record actual locations of pumps, valves, connections, and invert elevations.
- C. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities. Record elevations and accurate locations.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to the site under provisions of Division 01.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Protect from the weather, excessive humidity and excessive temperatures variation; and dirt, dust, or other contaminants all equipment delivered and placed in storage.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials must conform to standard specifications listed in Section 1.2.
- B. Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to contractor receiving Notice to Proceed. Equipment shall be supported by a service organization that is, in the opinion of the Engineer, reasonably convenient to the site.
- C. Provide each major item of equipment with the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.
- D. Provide Orenco Biotube ProPak 60-hz Pump Package BPP-P16-M21-20-SB-48-SD4.

2.2 SPECIAL TOOLS

- A. Provide one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment.

2.3 CONTROL PANEL

- A. Control panel should provide an elapsed time meter, alarm horn, and alarm light for each pump.
- B. Provide lights signifying when the power is on, Pump 1 is on, when Pump 2 is on, the high water alarm is triggered, and when the float switches are triggered out-of-sequence.

- C. Provide float switch status lights signifying when they are off, lead is on, lag is on, and when the high water alarm is triggered.
- D. Provide switches to allow each pump to either operate manually or automatically.
- E. Provide the option to switch the lead to be either Pump 1 or Pump 2.
- F. Button to test the system.
- G. See electrical specs for further information.

2.4 GATE VALVES

- A. Gate valves shall be as provided in Orenco's Biotube ProPak Pump Package.

2.5 CHECK VALVES

- A. Check valves shall be as provided in Orenco's Biotube ProPak Pump Package.

2.6 SUBMERSIBLE PUMPS

- A. Furnish and install two Orenco PF500512 submersible effluent sanitary pumps or approved equal to handle 30 gpm at 30 feet of total dynamic head.
- B. Each pump shall be equipped with a HP submersible electric motor connected for operation on 240 volts, 1 phase, 60 hertz, with sufficient length of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval.
- C. Pump mating, connections, discharge connection sealing, pump components, motors shall be as provided in Orenco's Biotube ProPak Pump Package.

2.7 PUMP CONTROLLER (OPERATIONS)

- A. The pumps shall operate based on demand-dose.
- B. On rising level, when the level is equal to or greater than the lead pump start set point, the lead pump will start.
- C. The pumps will work in an alternating, lead/lag sequence. At the end of every cycle, the lead/lag duty will be alternated to the next pump. (Example: 1st cycle Pump 1, 2nd cycle Pump 2).
- D. If the level continues to rise beyond the start lag pump set point, the lag pump will start operating simultaneously with the lead pump.
- E. If the level continues to rise past the high level set point for a set amount of time, the high level alarm will be triggered. Once the level falls below the high level point, the alarm will stop.
- F. On falling level, the pumps will sequence off as the level drops below the respective stop set points.

2.8 WATERTIGHT SEALS

- A. Discharge pipes should be sealed with Link-Seal or other approved watertight seal.

2.9 LIFT STATION BASIN

- A. The wet well shall be as indicated on the contract plans.

2.10 PIPE AND FITTINGS

- A. All piping within the wet well shall be as provided in Orenco's Biotube ProPak Pump Package.

PART 3 - EXECUTION

3.1 GENERAL

- A. All materials must conform to Section 1.02.
- B. Verify all dimensions in the field, and advise the Engineer of any discrepancy before performing the work.
- C. Submit drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show on the drawings proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.
- D. Install pumping equipment and appurtenances in the position indicated and in accordance with the manufacturer's written instructions. Provide all appurtenances required for a complete and operating pumping system, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.
- E. Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Ferrous surfaces shall be factory coated.
- F. Pump casings shall be constructed of cast iron of uniform quality and free from blow holes, porosity, hard spots, shrinkage defects, cracks and other injurious defects.
- G. Post, where directed, framed instructions containing wiring and control diagrams under glass or in laminated plastic. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. Post the framed instructions before acceptance testing of the system. Submit pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency and pumping horsepower from 0 gpm to 110 percent (100 percent for positive displacement pumps) of design capacity. Submit a complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, installation instructions, diagrams, instructions, and other sheets proposed for posting.
- H. Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the

specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

- I. Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. The representative shall supervise the installation, adjustment, and testing of the equipment.
- J. Submit performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. In each test report indicate the final position of controls.
- K. Provide a complete system in place including excavation, laying, bedding, backfill, and compaction, all in conformance with Section 31 00 00 Earthwork and the dimensions and sections indicated on the drawings or within the lines and grades established by the Engineer.
- L. Wet well hatch must have a lock and a lift-assist.

3.2 FIELD TRAINING

- A. Provide a field training course for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals. Submit six digital and hard copies of operation and maintenance manuals for the equipment furnished, include one electronic copy. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Include in the operation manuals the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. List in the maintenance manuals routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course.

END OF SECTION 33 32 16

SECTION 33 40 00 – STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes constructing storm drainage pipe and drainage structures.

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 PIPE

- A. Drainage pipe shall conform to Section 7-04.2 of the WSDOT Standard Specifications. Storm drainage pipe and roof leader pipe shall be Solid Wall PVC Storm Sewer Pipe conforming to Section 9-05.12(1) unless otherwise noted on the plans.

2.2 CATCH BASINS

- A. Catch basins and manholes shall be precast concrete structures conforming to Section 7-05.2 of the WSDOT Standard Specifications.

2.3 CLEANOUTS

- A. Cleanouts shall be of the same material as the pipe and shall conform with Section 7-19.2 of the WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 PIPE

- A. Pipe shall be installed in conformance with Section 7-04.3 of the WSDOT Standard Specifications.

3.2 CATCH BASINS AND MANHOLES

- A. Catch basins and manholes shall be installed in conformance with Section 7-05.3 of the WSDOT Standard Specifications.

3.3 CLEANOUTS

- A. Cleanouts shall be installed in conformance with Section 7-19.3 of the WSDOT Standard Specifications.

3.4 CLEANING AND TESTING

- A. All storm drains and appurtenances shall be cleaned and tested in accordance with the low pressure air method specified in Section 7-04.3(1) of the WSDOT Standard Specifications.

END OF SECTION 33 40 00

SECTION 33 41 00 – SUBDRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes constructing foundation drains and foundation drain cleanouts.

1.2 STANDARD SPECIFICATIONS

- A. All work to be performed and materials to be used shall be in accordance with the 2020 Standard Specifications and Standard Plans for Road, Bridge and Municipal Construction, as published by the Washington State Department of Transportation (WSDOT), unless otherwise indicated herein.
- B. The Contractor shall have one copy of the Standard Specifications and Standard Plans at the job site.
- C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS

2.1 FOUNDATION DRAIN PIPE

- A. Foundation drain pipe shall be Schedule 40 PVC (DWV) conforming to ASTM D 2665 or approved equal. Cellular-core (foam core) pipe is not acceptable. Perforated pipe shall have two rows of round 1/2-inch diameter holes spaced 120 degrees apart at 4 inches on center.

2.2 CLEANOUTS

- A. Cleanouts shall be of the same material as the pipe and shall conform with Section 7-19.2 of the WSDOT Standard Specifications.

PART 3 - EXECUTION

3.1 PIPE

- A. Pipe shall be installed in conformance with Section 7-04.3 of the WSDOT Standard Specifications.

3.2 CLEANOUTS

- A. Cleanouts shall be installed in conformance with Section 7-19.3 of the WSDOT Standard Specifications.

END OF SECTION 33 41 00

SECTION **32 94 13** - LANDSCAPE EDGING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Root barrier sheet material as shown on plans.
- B. Steel landscape edging – between planting beds and soldier course courtyard edging.

1.2 RELATED REQUIREMENTS

- A. Section 32 15 40 – Stabilized Aggregate Paving
- B. Section 32 91 00 – Planting Preparation.
- C. Section 32 93 00 – Plants.

1.3 REFERENCE STANDARDS

- A. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D 1004 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
- C. ASTM D 4833 / D 4833M – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
- D. ASTM D 5617 – Standard Test Method for Multi-Axial Tension Test for Geosynthetics.

1.4 SUBMITTALS

- A. Comply with Division 1.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Samples:
 - 1. Submit manufacturer's 12-inch by 12-inch sample of root barrier sheet material.
 - 2. Submit manufacturer's 3" sample section of steel landscape edging size and finish.
- D. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- E. Sustainable Design Submittals: Submit manufacturer's sustainable design submittals for root barrier sheet material.
 - 1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
 - 2. Regional Materials: Certify distance between manufacturer and Project, in miles.

- F. Manufacturer's Project References: Submit manufacturer's list of successfully completed root barrier sheet material projects, including project name and location, name of architect, and type and quantity of root barrier sheet material furnished.
- G. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 LEED SUBMITTALS

- A. For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
 - 1. LEED Submittal Coversheet
 - 2. Materials and Resources Submittals:
 - a. MR Credit BPDO - Sourcing of Raw Materials: Manufacturer's documentation demonstrating product claims of extended producer responsibility program, recycled-content, or FSC certified wood, in accordance with Section 01 35 15 – LEED Certification Procedures.
 - 1) Include manufacturer documentation confirming city/state/country of material extraction, manufacturer and purchase and air distance from these locations to project site for products extracted and manufactured within 100 miles of the project site.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged, for a minimum of 10 years, in the manufacturing of root barrier sheet material of similar type to that specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- 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 areas, protected from exposure to harmful weather conditions.
 - 4. Store materials out of direct sunlight.
 - 5. Protect materials during storage, handling, and installation to prevent damage.

1.8 AMBIENT CONDITIONS

- A. During Cold Weather:
 - 1. Do not use frozen materials.
 - 2. Do not use materials mixed or coated with ice or frost.
 - 3. Do not build on frozen Work.
- B. During Wet Weather: Do not build on wet, saturated, or muddy subgrade.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Root barrier

1. Manufacturer: NDS, Inc., or approved equal.
851 North Harvard Avenue, Lindsay, California 93247.
Toll Free 800-726-1994.
Phone 559-562-9888.
Toll Free Fax 800-726-1998.
Fax 559-562-4488.
Website www.ndspro.com.
Email nds@ndspro.com.

B. Steel Edging

1. Manufacturer: Sure-loc Edging Corporation, or approved equal.
494 E. 64th Street, Holland, MI 49423
(800) 787-3562
Website: www.surelocedging.com

2.2 MATERIALS

A. Root Barrier Sheet Material: Root barrier sheet material, part number SM-1820.

1. Material: Injection-molded, 1-piece polyethylene with UV inhibitors.
 - a. Recycled Content: 50 percent.
2. Sheet Size:
 - a. Depth: 18 inches
 - b. Length: 20 feet.
 - c. Wall Thickness: 0.040 inch to 0.060 inch.
3. Reinforcing Ribs:
 - a. Vertical, flared, molded, 90-degree, root-deflecting ribs protruding 1/2 inch from wall.
 - b. Spacing: 6 inches to 8 inches on center.
4. Sheet Ends: Root-impervious, molded end using staples or sealant to bind to next sheet.
5. Color: Black.
6. Physical Properties, 0.040-Inch Wall Thickness:
 - a. Break Strength, ASTM D 638:
 - 1) Machine Direction: 4,238 psi.
 - 2) Transverse Direction: 3,278 psi.
 - b. Break Elongation, ASTM D 638:
 - 1) Machine Direction: 725 percent.
 - 2) Transverse Direction: 607 percent.
 - c. Puncture Strength, ASTM D 4833: 111 lbs.
 - d. Tear Strength, ASTM D 1004:
 - 1) Machine Direction: 46 lbs.
 - 2) Transverse Direction: 42 lbs.
 - e. Hydrostatic Resistance: 403 psi.
 - f. Multi-Axial Tensile Properties, ASTM D 5617, Procedure A, Centerpoint Deflection Versus Pressure:
 - 1) Maximum Stress: 1,954 psi.
 - 2) Elongation at Rupture: 31.1 percent.

B. Steel Edging Material: Sure-loc™ steel edging

1. Material: edging to be manufactured from steel with interlocking system and stake punch outs fabricated in each strip.
2. Section Size: 16'
3. Physical Properties:
 - a. 1/8" thickness: for residential or light commercial applications where flowing curves are desired. Applications include but are not limited to, bed division, walkways, and light brick paver work.
 - b. Finish: powder coated, baked on enamel
 - c. Color: brown
4. Locking System: Sections to lock together without offset or double thickness at the joints and secured with 12" stakes at every joint.

2.3 ACCESSORIES

- A. Root Barrier Tape:
 1. Use to seal ends of sheets.
 2. Dual-sided, solvent-based tape.
 3. Tuff Industries, Inc.
- B. Steel Edging Stakes:
 1. Length: 12"
 2. Material: steel

PART 3 EXECUTION

3.1 LEED

- A. Refer to Section 01 35 15, LEED Certification Procedures for additional information relating to execution of the following LEED credits:
 1. Sustainable Sites – Construction Activity Pollution Prevention: Comply with provisions of 01 57 13 Temporary Erosion and Sedimentation Controls.
 2. Materials & Resources – Construction Waste Management: Comply with provisions of Section 01 74 00 Construction Waste Management.

3.2 EXAMINATION

- A. Root Barrier
 1. Examine areas to receive root barrier sheet material.
 2. Notify Architect of conditions that would adversely affect installation or subsequent use.
 3. Do not begin installation until unacceptable conditions are corrected.
- B. Steel Landscape Edging
 1. Check to ensure that all underground lines, irrigation hoses, and other cables are installed below the maximum depth of edging to be used.

3.3 INSTALLATION

- A. Root Barrier

1. Install root barrier sheet material in accordance with manufacturer's instructions at locations indicated on the Drawings.
2. Install root barrier sheet material plumb.
3. Linear/Root Pruning Applications: Place root barrier sheet material directly adjacent to hardscape being protected.
4. Surround Applications: Place root barrier sheet material around root ball, at sufficient distance to allow proper backfill.
5. Do not allow roots to circle or grow over top of root barrier sheet material.

B. Steel Landscape Edging

1. Trench
 - a. Define the area to be edged using string, garden hose or paint.
 - b. Using a spade or mechanical trencher, cut a trench along area to be defined to depth so that top of edging will not exceed 1/2" above finish grade.
 - c. Install edging with stake pockets on landscape side.
 - d. Top of edging not to exceed 1/4" above finish grade as shown below.
2. Staking
 - a. A minimum of 5 stakes per section are to be used with each section of edging.
3. Back Fill
 - a. Back fill on both sides of edging during installation leaving no more than two sections unsupported at one time.
 - b. Compact back fill along edging ensuring that top edge is no more than 1/4" above finish grade.

3.4 CLEANING AND PROTECTION

- A. Protect Work of this Section from damage during construction.
- B. Dispose of all waste material in compliance with project's Waste Management Plan in accordance with Section 01 74 00 - Construction Waste Management.

END OF SECTION